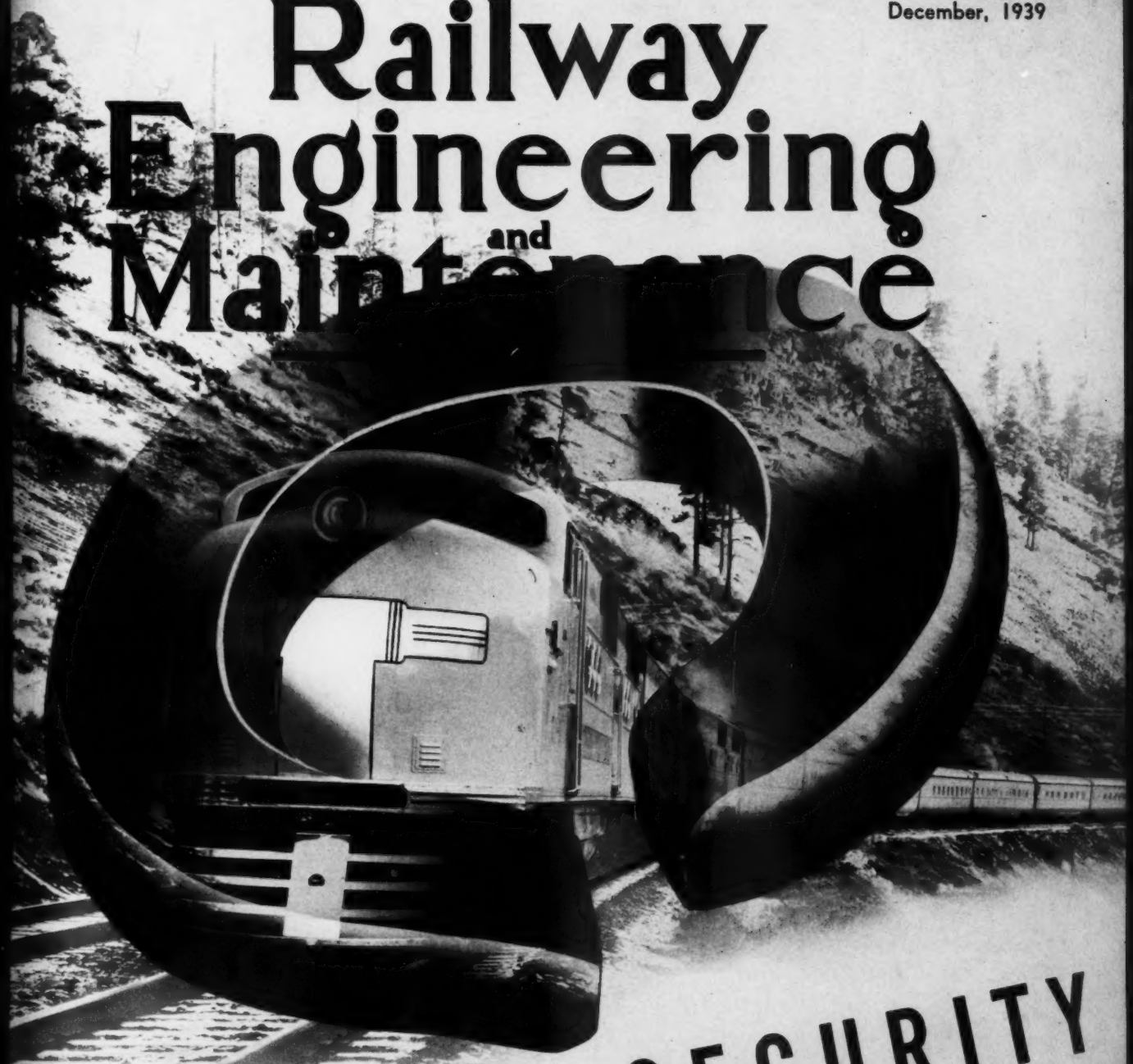
December, 1939

Railway Engineering and Maintenance



PROTECTION SECURITY

IMPROVED
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SPRING WASHERS!

ABSORB AND DIFFUSE THE ENORMOUS
IMPACTS OF HIGH SPEED MODERN TRAFFIC

Reliance HY-CROME *Spring Washers*

HY-CROME BOLT SECURITY

Bolt Looseness

AND THE REMEDY

- **LOOSE BOLTS** are the initial step towards undermining the efficiency of any bolted assembly.
- **TIGHT BOLTS** reduce maintenance costs and substantially contribute toward efficient assembly conditions and safe travel.
- **HY-CROME SPRING WASHERS** through many years of service have efficiently and economically met the demands made upon them, without failure.
- **SCIENTIFIC METHODS** used in their production insure non-fatigability — adequate reactive range — sufficient reactive pressure and a pre-determined tension to anticipate wear.
- **YOUR FASTENING PROBLEMS** if submitted to our research and testing laboratory might be solved in a preliminary or permanent way. A special type of Hy-Crome Spring Washer for every bolt problem. Our co-operation is at your disposal.

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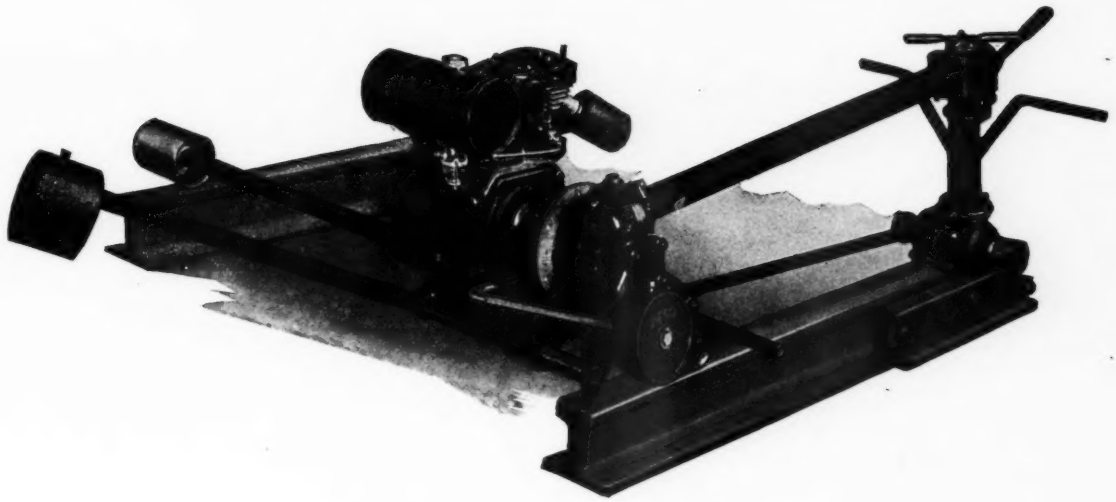
Published monthly by Simmons-Boardman Publishing Corporation, 105 W. Adams St., Chicago, Ill. Subscription price: United States and Possessions, and Canada, $2.00; Foreign, $3.00. Single copies 25 cents. Entered as second-class matter January 20, 1933, at the postoffice at Chicago, Ill., under the act of March 3, 1879, with additional entry at Mount Morris, Ill., postoffice. Address communications to 105 W. Adams St., Chicago, Ill.

Use
Raco Power Track Machine



When

Tightening out of face.

Removing worn rail.

Installing new rail.

Changing angle bars.

Shimming angle bars.

Tightening frog bolts.

Welding rail.

Grinding or slotting rail.

Installing screw spikes.

Because

It saves its cost in approximately 35 working days.

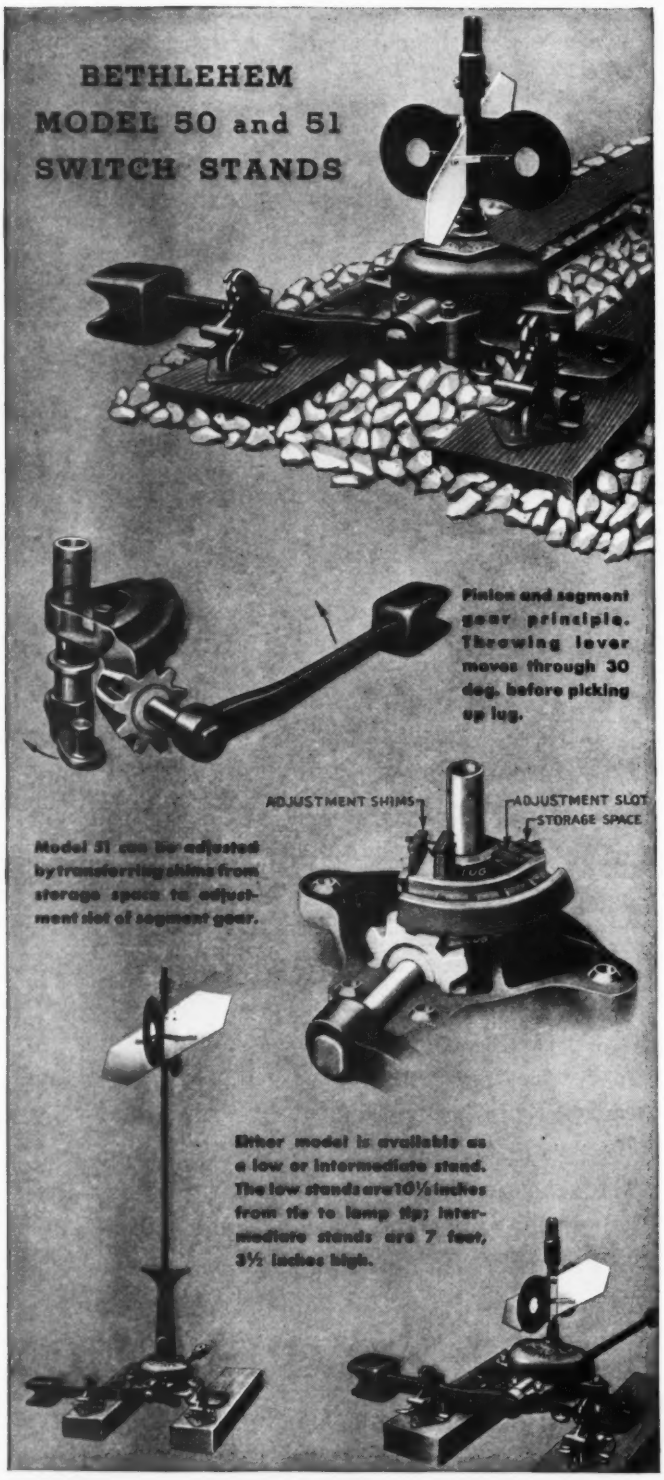
And because machine tightening has the following very important advantages:

Puts uniform tension on all bolts.
Costs one-third of hand tightening.
Lasts more than twice as long.
Greatly reduces rail batter.
Prevents frozen joints.
Saves joint ties.
Reduces angle bar wear.
Extends tamping periods.
Makes better riding track.
Hence saves rolling stock.
Confines expansion to individual rails.
Extends life of signal bonds.

RAILROAD ACCESSORIES CORPORATION

MAIN OFFICE
405 LEXINGTON AVENUE
(Chrysler Building)
NEW YORK

New Century switch stand


BETHLEHEM
MODEL 50 and 51
SWITCH STANDS
Pinion and segment gear principle. Throwing lever moves through 30 deg. before picking up lug.
ADJUSTMENT SHIMS
ADJUSTMENT SLOT
STORAGE SPACE
Model 51 can be adjusted by transferring shims from storage space to adjustment slot of segment gear.
Either model is available as a low or intermediate stand. The low stands are 10½ inches from tie to lamp lip; intermediate stands are 7 feet, 3½ inches high.

for all points of heavy traffic

A greater number of New Century Switch Stands are in service today than any other single type. Parallel-throw, easy to operate, dependable, and economical to maintain, they are ideal for all points of heavy traffic, whether on main lines, branch lines, or in yards.

Action is of the pinion and segment gear type: Power is transmitted from the throwing lever through an alloy-steel shaft to a malleable-iron pinion gear. This vertical pinion gear meshes with a horizontal segment gear. As the segment gear rotates, it "picks up" a lug on the vertical spindle, causing it to turn, move the connecting rod, and throw the switch.

Ease of operation is an important feature of the New Century stand. The throwing lever operates through an arc of 30 degrees before moving the points. Thus a trainman can throw the heaviest switches with little more effort than that of raising the 30-pound weighted lever.

All parts are of heavy construction: the spindle is a one-piece drop forging; pinion and segment gears are high-quality malleable castings; the shaft is of heat-treated alloy steel. Bearings are of sufficient size and are so located as to provide stability and minimize wear.

The New Century switch stand is positive when latched. It is made in two models which differ only in the method of adjustment. Model 50 is adjusted at the connecting rod. In Model 51 adjustment shims are inserted in or removed from the segment gear slot, permitting independent adjustment for the throw of either point without disconnecting the stand.

Throughout the country you will find roads using the New Century switch stand almost exclusively. Many are getting satisfactory service from stands installed more than 15 years ago, excellent proof of rugged, dependable construction.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY

FAIRMONT LEADS IN FEATURES THAT SERVE YOU BEST

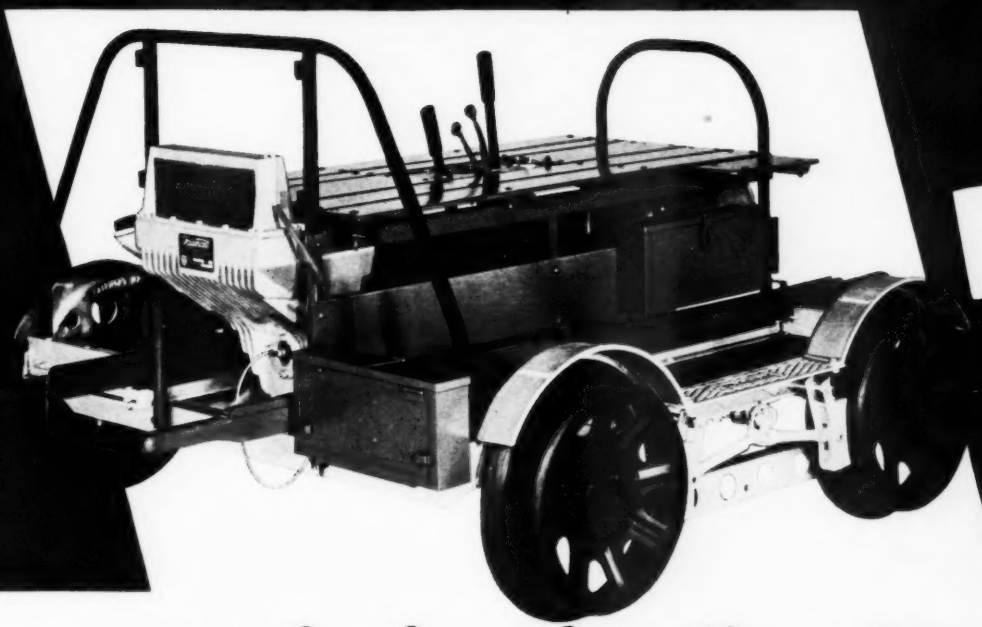
5-8 H. P. ROLLER BEARING ENGINE

FOUR WHEEL BRAKES

ENDLESS CORD BELT DRIVE

SPRING MOUNTED CHASSIS

REAR LIFT 95 POUNDS



Roadmasters Can Carry Extra Men or Travel Alone

ON THE *Fairmont* *M19* SERIES "E" *CAR*

Here is the ideal equipment for long inspection tours or for emergency repair trips. The Fairmont M19 Series E Car will not only seat four men but has two large trays for luggage, tools and supplies. Springs at each wheel cushion the riders from rail-joint shock and vibration. Lift handles extending front or rear permit easy removal of this car from the track by one man. The rear lift is only 95 lbs. Powered by Fairmont's Hy-Load Roller Bearing Engine, the M19 Series E is economical to operate and maintain. Bulletin 396, containing full information on this popular model, will be sent upon request. Fairmont Railway Motors, Inc., Fairmont, Minnesota.

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OF ALL THE CARS IN SERVICE TODAY

More Than Half are Fairmonts

Yours TO COMMAND!

ON every project involving the use of steel, questions arise which can be most economically answered by men whose training and experience have made them experts in steel and its application.

At a word from you, the specialists of Carnegie-Illinois are ready to swing into action—to analyze your problems—and to give you their earnest shoulder-to-shoulder cooperation in helping you solve all questions connected with steel, to your best advantage.

Such Carnegie-Illinois Service means constructive help based on an engineer's interpretation of that term. It is founded on a firm determination to give you the benefit of our constant, never ending search for new methods of improving steel and its application to engineering structures — and for new ways to help you build better structures at lower cost.

This Service is yours to command.

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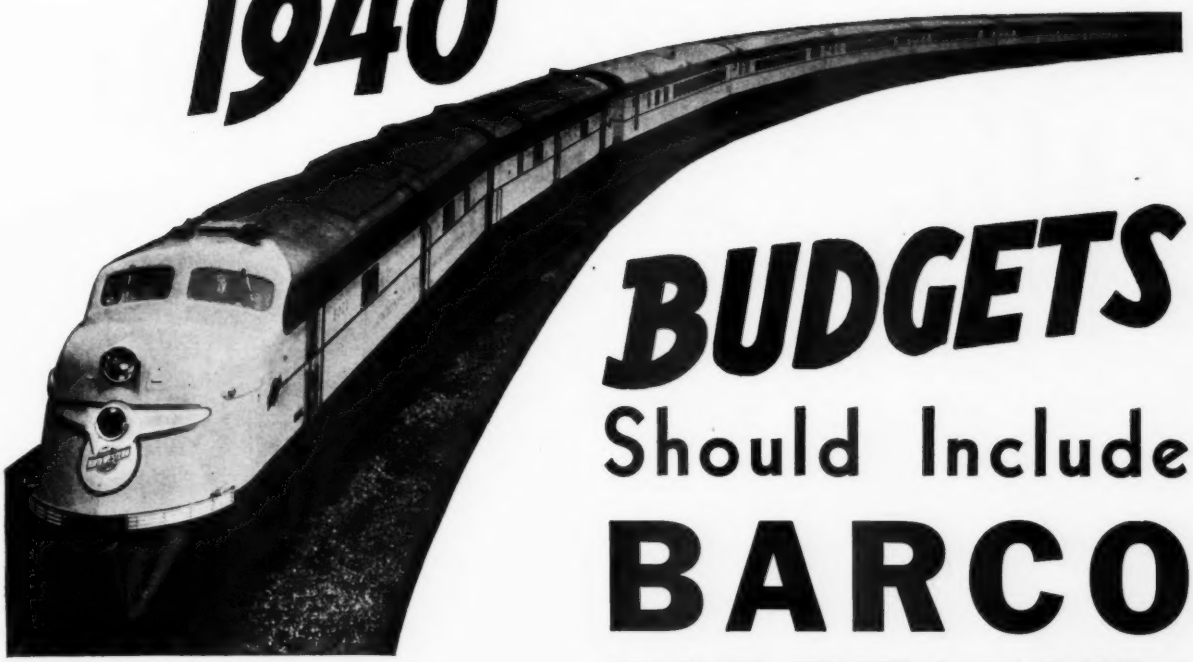
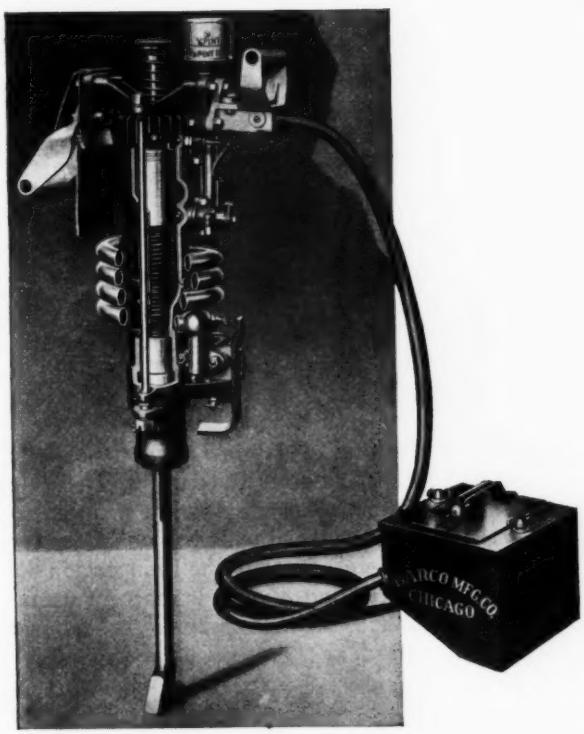
UNITED STATES STEEL

1940 BUDGETS Should Include BARCO UNIT TYTAMPERS





Lower Initial Capital Expense for Equipment.

Lower Operating Cost.

All Year Around Service in Gangs or in Individual Units.

Entirely Self-Contained—Carried by One Man—No Auxiliary Equipment Required.

BARCO provides the Most Flexible, Convenient and Efficient Method of Maintaining Thoroughly Tamped Tracks, as Evidenced by Their Widespread Use.

NOW 51 RAILROADS USE BARCO

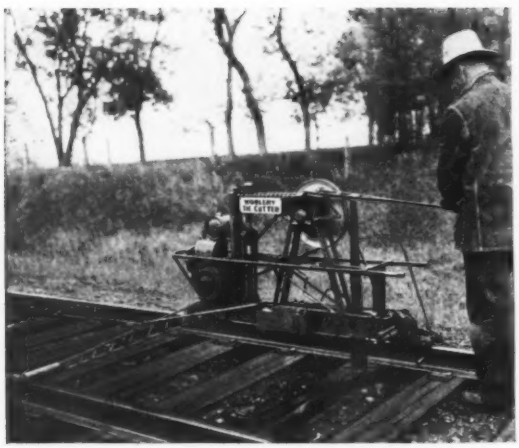
BARCO MANUFACTURING COMPANY
1805 W. Winnemac Ave. Chicago, Illinois

In Canada
THE HOLDEN COMPANY, LTD.
Montreal — Moncton — Toronto — Winnipeg — Vancouver

Why Not Put Them on your Budget

AND

- Save 30% On Next Year's Tie Renewals!
- Complete Your Program Weeks Ahead of Schedule!
- Minimize Disturbance of Tie Bed and Track!



The Woolery Tie Cutter is rugged — compact — rides easily on side of motor car to point of use—light in weight —can be easily removed from the track by its operator in 10 seconds.

Renew Your Ties the Modern Way

The WOOLERY TIE CUTTER

saves 12 cents or more on every tie renewed—speeds up the work and makes it *easier* by cutting the tie in three easily-handled pieces—eliminates the struggle to pull out a useless tie *intact*—removes the necessity for digging out the crib—takes away the temptation to renew an adjacent tie having a year or more of useful life—avoids disturbance of the compacted bed on which the old tie rested.

INVESTIGATE NOW—Send for 12-page Booklet.

WOOLERY MACHINE COMPANY

MINNEAPOLIS — Pioneer Manufacturers of — MINNESOTA

RAILWAY MAINTENANCE EQUIPMENT

TIE CUTTERS • SWITCH HEATERS • MOTOR CARS

RAILWAY WEED BURNERS • BOLT TIGHTENERS

No postage required

Tear out

Check off the ones you want

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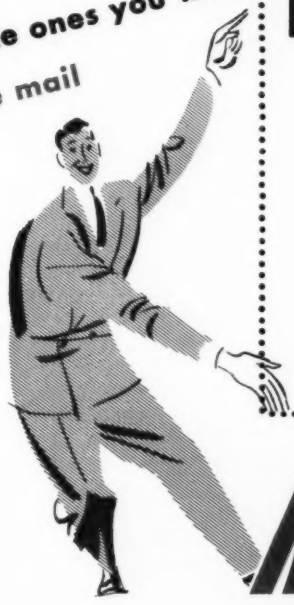

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PRODUCT INFORMATION

KOPPERS

PRESSURE-TREATED LUMBER FOR RAILROAD CARS

Railroads have saved tremendous sums of money (estimates run as high as $150,000,000.00 a year) through the use of pressure-treated cross ties, bridge timbers, etc. Comparable savings can be made by the use of pressure-treated car material.

LIFE EXPECTANCY OF UNTREATED AND PRESSURE TREATED CAR STOCK. A large percentage of failures of car lumber are due to weakening of the material by incipient decay. Frequently mechanical failure is mistakenly reported when breakage or failure actually is due to decay. Pressure-treated car lumber in service under conditions identical with that of untreated lumber has served several times as long as the latter. One railroad reported there had been no replacement, except that due to wrecks, of pressure treated lumber after 14 years of service in stock cars and that an average life of 20 to 25 years or more was anticipated. Untreated stock car lumber on the same railroad had a life of only 2 to 8 years.

RESISTANCE OF TREATED LUMBER TO WEAR. Lumber treated with creosote oil resists wear as well as decay. The creosote acts as a lubricant to reduce mechanical abrasion and it makes the lumber water repellent, thereby reducing splitting and checking.

Stock cars of pressure treated joist.

Checking is sometimes caused by uneven drying of the wood, the loss of moisture from the exterior being more rapid than the movement of moisture from the interior toward the surface. Creosote preservatives materially retard this drying action by slowing the rate of moisture absorption and evaporation.

TYPES OF PRESERVATIVE TREATMENTS. Where the exposure is severe, or where mechanical abrasion is a serious factor, pressure treatment with creosote oil is preferred. In places where odor and stain are objectionable (such as lining and flooring of cars for loading grain and other food products) or for places where oil might be slippery when wet (as on running boards) The Wood Preserving Corporation provides lumber pressure-treated with CHROMATED ZINC CHLORIDE or "WOLMAN SALTS."

PAINTABILITY OF PRESSURE-TREATED LUMBER. Wood treated with CHROMATED ZINC CHLORIDE or "WOLMAN SALTS" may be used for the same purposes for which untreated wood is used, since its paintability is not changed in any way. Where creosoted wood can satisfactorily be used there is an additional saving in that

Railroad car decking loaded on trucks ready for pressure treating.

Pressure-creosoted railroad car decking ploughed to joist.

Pressure-creosoted blank floor decking for flat cars.

THE WOOD PRESERVING CORPORATION • PITTSBURGH • PENNSYLVANIA

This folder tells . . .

How railroads can decrease failures of car lumber.

What parts of cars should have pressure-treated lumber.

What type of treatment to use for various car parts.

Railroads which have successfully used pressure-treated car stock.

Use the postcard to send for your copy. Free.

SEE OTHER SIDE

KOPPERS COMPANY, Pittsburgh, Pa.
Please send me the following product information:

- ☐ Pressure-treated Timber
- ☐ Pressure-treated timber in railroad cars
- ☐ How to measure effectiveness of pressure treatments of timber
- ☐ Typical Highway Bridges of Pressure-treated Timber
- ☐ Pressure-treated Piling
- ☐ Pressure-treated Poles
- ☐ Pressure-treated timber in company houses and buildings
- ☐ Prevention of Termite Damage to Buildings
- ☐ Painting of Creosoted Wood
- ☐ Sectional Packing for Locomotive Main Cylinders
- ☐ Sectional Packing for Locomotive Valves
- ☐ How to Order Piston Rings
- ☐ Piston Rings for Diesel Motors
- ☐ Piston Rings for Bearings
- ☐ Roofing and Waterproofing Specifications
- ☐ How to Build Steep Roofs with Coal Tar Pitch
- ☐ Spray Pond or Flooded Roofs
- ☐ Membrane Waterproofing
- ☐ Dampproofing
- ☐ Coals for Various Purposes (C-3)
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- ☐ Stoker Coals
- ☐ Creosote
- ☐ Fast's Self-aligning Couplings
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KOPPERS AMERICAN SECTIONAL BRONZE-IRON PACKING
RESTRAINED TYPE SECTIONAL PACKING
For Locomotive Main Cylinders

These folders tell . . .

How to reduce friction and wear on cylinder and valve packing and cylinders.
How to prevent loss of steam or blow-by.
How to assure uniform distribution of oil on cylinder walls.
How to increase life of packing.
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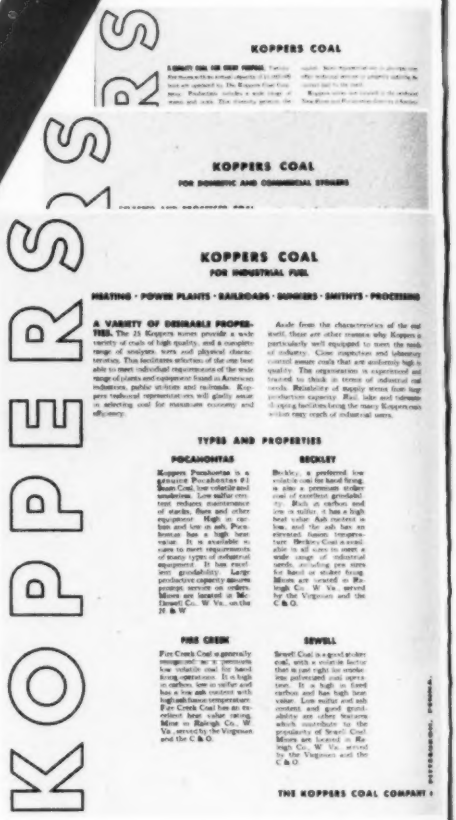

These folders tell . . .

How to pick the right coals for specific purposes.
How to get best results with stoker coals.
How various coals rate as to ash, sulphur, etc.
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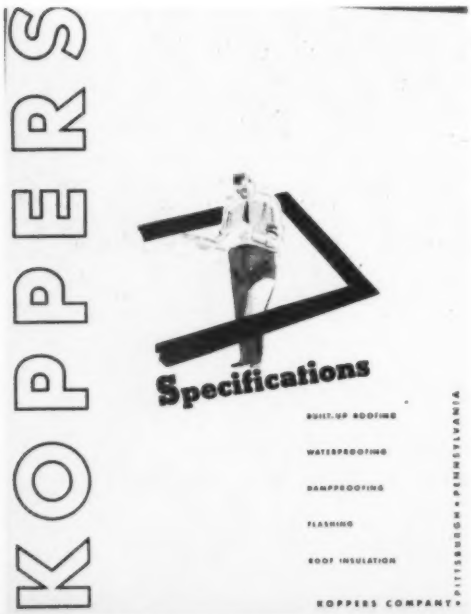
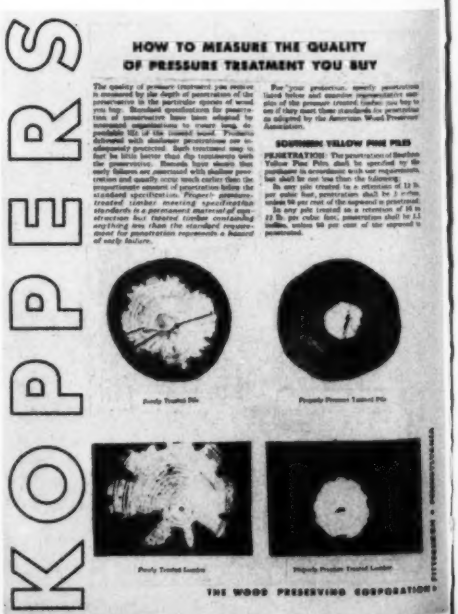


This booklet tells . . .

How to get longer-lasting roofs.
How to get bonds on steep roofs.
How to build roofs for every type of deck.
How to waterproof bridge decks, retaining walls and other types of construction.
How to prevent leaks in foundations.
How to prevent decay of wood floors exposed to dampness.
Use the postcard to send for your copies. Free.



This folder tells . . .

Why depth of penetration of preservatives determines the life of treated timber.
What shallow penetrations do to pressure-treated timber.
How to make adequate tests of penetration of piles, poles, structural lumber.
Use the postcard to send for your copy. Free.

To Assure Maximum Safety

rails in tracks of

THE UNION PACIFIC

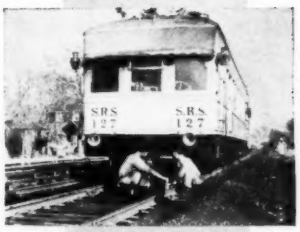
including routes of such famous trains as

"City of Los Angeles"
"City of Portland"
"City of Denver"
"City of San Francisco"
and "The Challengers"

are regularly tested by

MODERN SPERRY DETECTOR CARS

OPERATED SOLELY BY SPERRY RAIL SERVICE • HOBOKEN, N. J. • CHICAGO, ILL.



Testing of rails in track with Modern Sperry Detector Car

Sperry Operator interpreting indications registered on Record Tape

No. 132 of a series

Railway
Engineering and Maintenance
SIMMONS-BOARDMAN PUBLISHING CORPORATION

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: A Duck's No Dummy

December 1, 1939

Dear Reader:

As I have noticed flock after flock of mallards, teals, pin tails and other species of ducks winging their way southward in largely increased numbers this fall, I wonder if you have been impressed as I have with the thought that in this migration these ducks are showing that they have sense enough to know that they cannot survive the rigors of the frozen north, and also that, if they make the effort, they will find food and warmth in the bayous and rice fields of the south. And in their recognition of this call and the determination displayed in their flight, has it occurred to you that these ducks set an example that their human enemies might well emulate?

Take the railway supply industry as an example. In the months of September and October the railways experienced the most rapid increase in traffic in their history and since that time this gain has been held, with the result that car loadings are now running about 18 per cent above those of the corresponding periods of both 1938 and 1937, and the net operating income of the railways is rising even more rapidly. This in turn is leading to greatly increased purchases, one excellent illustration of which is the ordering since September 1 of more than 800,000 tons of rails, a tonnage 75 per cent greater than the total laid in all of 1938.

Such purchases evidence the rapidly broadening market that is developing not only for the manufacturers of the basic materials of railway use but equally so for the far greater variety of other materials that can be used advantageously by the railways if the manufacturers will bring the merits of these products to the attention of railway officers.

The year 1940 will point the way to better "feeding grounds" for manufacturers of those materials and devices that are adapted to the construction and maintenance of railway tracks, bridges, buildings and water service facilities. Will these manufacturers emulate the ducks and take the necessary steps to reach these grounds?

Yours sincerely,

Elmer T. Howson

ETH:EW

Editor

MEMBERS: AUDIT BUREAU OF CIRCULATIONS AND ASSOCIATED BUSINESS PAPERS, INC.

You *STREAMLINED* your trains... now what about your *STATIONS?*

These two pictures show how effectively old stations can be modernized with versatile Douglas Fir Plywood

• With the use of Douglas Fir Plywood, old railway stations can be easily and economically remodeled to give the same attractive appearance and the same comfort as your new streamlined trains.

The outdoor grade of Douglas Fir Plywood, EXT-DFPA, applied over the exteriors of old buildings makes them windproof, dustproof and stronger. Douglas Fir Plywood wallboard, Plywall, provides a puncture-proof covering for cracked plaster.

The utility grade, Plyscord, is an unsurpassed sheathing material. It makes walls 5.9 times as rigid as horizontal board sheathing.

Decide now to learn more about this engineered lumber. Remember, every panel is "grade trademarked" to make specification and identification easy.

BEFORE

AFTER

Weather-proof EXT-DFPA builds this smart, modern exterior!

There's nothing "fragile" about the outdoor grade of plywood. Made with permanently water-proof glue, the big, lightweight panels resist any sort of weather conditions. They work easily with all tools. Easy to paint. Dirt and soot wash off quickly.

Left: 4000 Plywood Ceilings

All of the 4000 new freight cars being built by the Union Pacific have plywood ceilings to protect ladings from dirt and damage.

For Specific Recommendations

or for literature on plywood construction, write Douglas Fir Plywood Association, Tacoma, Wash.

GENUINE DOUGLAS FIR PLYFORM Concrete Form Panel D.F.P.A. INSPECTED

GENUINE PLYWALL Douglas Fir Plywood WALLBOARD D.F.P.A. INSPECTED

SPECIFY DOUGLAS FIR PLYWOOD BY THESE "GRADE TRADE-MARKS"

PLYPANEL D.F.P.A.

EXT.-D.F.P.A.

GENUINE PLYSCORD SHEATHING D.F.P.A. INSPECTED

DOUGLAS FIR PLYWOOD

Real Lumber

MADE LARGER, LIGHTER SPLIT-PROOF STRONGER

Oxweld Railroad Service TOPICS

1912 — OVER A QUARTER CENTURY OF SERVICE TO AMERICAN RAILROADS — 1939

ELIMINATE JOINT MAINTENANCE
by butt-welding rail

Smooth-riding track requiring no joint maintenance is provided by the Oxweld Automatic Pressure-Type Butt-Welding Process. Using only the original rail metal this process produces welds which are uniformly high in quality. A completed weld is shown below. The Oxweld Railroad Service Company's special equipment is used when rail for open track, bridges, crossings, tunnels, and station platforms is butt-welded by this method. The Oxweld Butt-Welding Process is the result of extensive laboratory development to assist railroads in reducing maintenance costs.

HAND BUTT-WELDING
for small programs

For small programs and for tying-in long lengths of pressure-welded rail in track, the hand butt-welding technique is employed. In this method two welders work simultaneously on opposite sides of the rail, completing the weld without stopping. Only standard welding apparatus is used in the hand-welding technique. For special installations such as the turntable circle rail illustrated, this method is invaluable.

• BRIEFS •

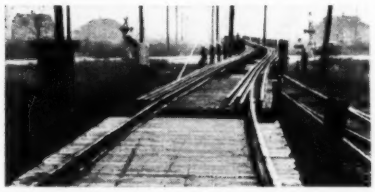
Acetylene Flood Light—The Prest-O-Lite (Railroad Type) Acetylene Flood Light is useful for emergencies or for night maintenance-of-way work. It produces a brilliant white light of about 4,000 candlepower.

• • •

End-Hardening Rail—With equipment especially designed by Oxweld, adjoining ends of new rail are simultaneously hardened in track to provide resistance to batter.

• • •

Reprints Available—Additional information on the Oxweld Automatic Pressure-Type Butt-Welding Process



is contained in an article which appeared recently in *Railway Engineering and Maintenance*. A reprint of this article will be sent without obligation, upon request.

• • •

In addition to bringing to railroads the oxy-acetylene process applications described on this page, Oxweld Railroad Service provides for welding signal bonds, installing welded piping systems, building-up rail ends, hard-facing wearing parts, and Unionmelt welding. For complete information on any of these operations, consult The Oxweld Railroad Service Company, Unit of Union Carbide and Carbon Corporation, Carbide and Carbon Building, Chicago and New York.

OXWELD RAILROAD SERVICE

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Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE

DECEMBER, 1939

Editorials - **747**

Waterways—Thermal Insulation—Winter Preparations

Stabilizing the Roadbed Through Subdrainage - - - - - - - - - **750**

H. E. Cotton, drainage engineer, discusses the various water conditions which cause soft roadbed and how to overcome them

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Railway Engineering and Maintenance

Waterways

River Transportation is Not Cheap

THIS editorial is written by a United States senator—a man who knows railway operation through 20 years' service as a railway mail clerk and superintendent of railway mail service—a man who appreciates the public interest in efficient and economical transportation through four years' service as chairman of the public utilities commission of his state, followed by two years as governor of that state—a man who is equally familiar with the problems of shippers through service as chairman of one of the country's most active regional advisory boards from its organization in 1923 until his election to the United States Senate last year—and a man whose knowledge of transportation matters was recognized in the Senate by his prompt appointment to the highly important Senate Committee on Interstate Commerce. This man is Clyde M. Reed of Kansas. His editorial is abstracted from an address which he delivered before the annual convention luncheon of the National Industrial Traffic League at Chicago on November 21.

Starting from the premise that there is no justification or need for the subsidization of any form of transportation today and that every such agency should carry the full load of the investment made in its behalf, Senator Reed laid down the broad principle that tolls should be imposed upon all traffic using facilities created out of the public treasury sufficient to compensate the taxpayers reasonably for the money taken from them. If that were done, he said, traffic would move by the cheapest and best route.

From this broad basis, Senator Reed then turned specifically to the waterways. The following is quoted from his address:

River Transportation Most Expensive

"The inland waterways never have, do not now, and never can handle traffic as efficiently, as expeditiously, or as cheaply as the railroads; or for that matter, as the highways. True, inland river transportation is not 'cheap' transportation. It is not low cost transportation. It is the highest cost of any of the general forms of transportation. The difference between the charges on the inland waterways and on the railroads and the highways is made up by a subsidy out of the public treasury which is paid by the taxpayers as a whole. Of course, low river rates can be maintained if the taxpayers' money improves the channels of the rivers, provides the wharves, and pays all expenses except the actual operation of a boat or barge. In this connection, it must be considered that the railroads which compete with the waterways are taxed to meet part of the cost of creating and maintaining a river channel right-of-way for their competitors.

"There is no justice in such a policy. Even when adequate and complete regulation of railroad service was achieved, the pressure for inland waterway improvement did not cease. By that time it had pretty largely become a 'racket.' It is that now. Many smart men are making a living out of promoting a so-called 'inland waterway improvement.' They get support from cities, from newspapers, from large corporations that own their own barges and can move their own freight on a publicly built right-of-way at a lower charge than the railroads make; they make a business of interesting chambers of commerce and commercial bodies; in putting pressure on senators and representatives for huge appropriations for 'river improvement' which will give some particular city or number of cities a 'freight rate advantage.' To these commercial bodies, to the newspapers which advocate this policy, the only thing of interest is their immediate advantage. They are willing to have the general public taxed for benefits for themselves, for their own communities, and for the traffic of large corporations.

A Waste of Public Money

"The important thing in this connection is whether we are going to continue to tax the whole people for the benefit of a comparatively small number of people. Are the cities and trade centers located off the rivers to be not only taxed, but additionally penalized by lower freight charges given their competitors located on the rivers? My answer is, 'No.'

"There is no more outrageous and no more unjustifiable, and no more flagrant waste and misuse of public money than in subsidizing high cost transportation for the benefit of a comparatively few people, and creating favoritism and discrimination between localities, trade

centers and cities. I find no fault with Great Lakes transportation which is efficient and economical transportation, but as long as I am a member of the United States Senate, I shall oppose this 'inland transportation racket.'

"We members of Congress are pestered by waterway racketeers, as well as by some earnest and honest people who do not understand that to not only maintain but to extend the public subsidy given is uneconomic transportation. These men appear before committees of Congress, purporting to represent farm organizations and appeal to farmers as being benefitted by 'cheap river transportation.' I would not undertake to say that no case can be found where some individual farmer may have secured a slight benefit in the price of his grain because of subsidized river transportation, but I do make the flat declaration that the farmers as a whole have not profited a cent by the billions of dollars spent on 'river improvement.' If traffic moving on the rivers had to pay all of the cost attached to river transportation, including the improvement and maintenance of the channel, no traffic of any consequence would move upon the rivers.

No Saving to the Public

"The inland waterway racketeers, individuals and organizations hold out to the public the idea that it is getting some benefit from raids upon the public treasury to make river navigation possible. The fact is that the bulk of the tonnage moving upon channels created with public money belongs to great corporations that own their own boats and move their own traffic. In most cases the commodities so moved are sold to the public, not on a basis of lower river rates, but on a basis of the higher railroad rate. The great corporations pocket the difference. This has been proven over and over again. The great oil companies, the great cement companies, the great steel companies, the great coal companies move their own traffic on their own boats and barges, and sell to the public, generally speaking, on a railroad rate basis. They take an additional profit because of what has been done with public money.

"We in Congress meet with a singular phase of this situation. There are great newspapers, all of which claim to be reputable, and most of them are, which will condemn rackets and racketeers for corrupt and wasteful use of taxpayers' money in their own cities, but which will advocate a policy that is more wasteful than any political machine in their own city has ever been. When we talk about public morality in the handling of public money, I find it difficult to make a distinction between Tom Pendergast taking a million dollars out of Kansas City's treasury, and Missouri River promoters inducing the United States to waste $200,000,000 trying to make the Missouri river navigable. It can't be done, but even if it could be done successfully, the benefit derived would be nothing in comparison to the money spent.

"A sovereign should do justice as between his subjects. We have three competing forms of transportation: i.e., the railroads, the highways and the inland waterways. The railroads provide and maintain their own right-of-way. Motor vehicle operators on the improved highways pay substantial sums in the form of fees, tonnage taxes, personal property taxes, and gasoline taxes for the use of the highways. Whether the sums so paid are adequate or not is a matter of dispute, but there is no dispute over the fact that they are a substantial sum. Both of these forms of transportation are regulated by the sovereign; in other words, the Government.

Simple Justice Demanded

"Their competitor upon the river has his right-of-way furnished and maintained without cost to him. There is no justice in that policy, but he objects to regulation. The Wheeler-Lea bill brings water transportation under regulation comparable to that imposed upon the railroads and the highways. That is simple justice. No fair-minded man can object to that policy. The bill by its terms requires the Interstate Commerce Commission 'to recognize and preserve the inherent advantages' of each form of transportation. No fair-minded man could ask more."

Thermal Insulation

Is Profitable in Railway Buildings

IN NO phase of railway operation is economy sought more intensively than in engineering, for it is almost routine to inquire into the relative economy of suggested and alternate proposals for almost everything that is done by the engineering and maintenance of way departments. And, although erroneous conclusions are sometimes drawn, the results of these inquiries are little short of amazing when one compares present practices with those of only a decade or two ago.

Yet despite the enormous strides that have been made in the efficiency and economy of methods and in the use of materials, one opportunity for making attractive savings has been overlooked, except on a few roads, this being in the heating of buildings. It is true that prior to 1929 many central heating plants, employing steam or hot water, were installed in medium-size stations, and these were a distinct advance over the waiting-room and office stoves that they displaced, with respect to comfort and economy.

On the other hand, full advantage of the opportunity to economize on fuel was taken in only a limited number of cases, this being particularly true where the buildings were of frame construction, for, with few exceptions, in both stations and offices, the potential heating value of the fuel is being dissipated through walls, roofs and floors that are far from being weather tight. It makes little difference what the type of heating equipment may be, stoves, hot-air furnace, steam or hot-water plant, if the building contains air leaks, and most railway frame buildings do to a greater degree than is generally realized, much of the heating value of the fuel consumed will be wasted.

That the greater part of this waste can be prevented is not open to debate, for both tests and experience have shown that through the application of thermal insulation to roofs, walls and floors, almost any desired percentage

of the heat delivered by the heating plant can be retained in the building, just as heat can be prevented from entering a cold storage room. Obviously, it is neither practicable nor desirable to retain all of this heat because the cost would be out of line with the benefits, and to do so would necessitate the elimination of ventilation.

There is a middle ground, however, where the benefits in comfort and conservation of fuel are in conformity with the cost of applying insulation, this zone lying in the range of saving from 40 to 60 per cent of the heat delivered by the plant. In many buildings having a high degree of leakage, a saving of as much as 75 per cent of the fuel now being consumed can be made at no greater expenditure for insulation than is necessary in buildings of better construction.

Building maintenance has been sadly neglected on most roads for a decade. In many instances the time is close at hand, if it has not already been reached, where major repairs will be necessary. This is the time, therefore, to plan the installation of thermal insulation, for it can be applied at a cost only a little greater than that of the material. No road can afford to omit a needed improvement that will pay for itself in three to six years and then continue to pile up profits during the remainder of its service life. Thermal insulation has demonstrated its ability to do this where proper application has been made.

Winter Preparations

An Added Responsibility This Year

MANY maintenance of way men over the country have their plans and facilities ready for winter, and to them these comments are not addressed. But there are others who are in a less fortunate situation, and who, with winter fast approaching, with the added difficulties which it invariably presents to efficient, on-time train operation, may well take heed.

With the added burdens and responsibilities which have been placed upon track maintenance officers in recent years, and especially during the present year as the result of the unprecedented increase in railway traffic during recent months, these men have been hard pressed in many cases to close up their year's maintenance programs and put their tracks in good condition to go through the winter. It is not surprising, therefore, that some of them have not yet had time to complete the many details involved in lining up their forces and equipment to cope with winter storms. However, safe as they have been in this neglect to the present time, it is certain that it cannot be continued much longer without the hazard of serious consequences.

The most important factor which has burdened maintenance men in recent months is the same one which makes it imperative that nothing be left undone to insure the safe, on-time movement of trains during the coming winter, regardless of storms, and that is, the heavier traffic that is being handled and that is in prospect for the months immediately ahead. Railway managements, through the Association of American Railroads, have assured the country that the railways have the facilities and are preparing to handle expeditiously all of the traffic which may be offered them under either normal or emergency conditions, and with the co-operation of the government and shippers, they are, no doubt, correct. However, it is certain that this estimate of the ability of the railways does not allow for long tie-ups out on the line or in terminals because of winter storm conditions. At the same time, no one will question but that a generally severe winter, combined with heavy traffic and lack of the most effective means for keeping the tracks open, could interfere seriously with the well publicized boast of the railways—a situation which must not occur.

It is true that no one knows exactly what traffic and storm conditions lie immediately ahead, but with every indication that traffic will be heavier than during recent winters, and the knowledge that winter storms are no respecters of the railways, there will be little acceptable excuse for not being prepared. This means the prior organization of men, materials and equipment, each in its place or lined up to be there on short notice, because every track maintenance man knows that the secret of coping successfully with a severe storm is to keep abreast of it, and not let it get a start or out of hand. He knows too that the men must be well clothed and fed to carry on their work most effectively, and that all snow-fighting equipment, including switch heaters, plows, flangers and tractors, must be in first-class operating condition.

And every bridge, building and water service man knows that he also has certain added responsibilities during the winter months, which, if not met, can be as serious to smooth and efficient train operation as snow-bound track. In fact, with low temperatures, as well as storms to guard against, he knows that his problems may be even more severe and prolonged than those of the track forces.

But it is not so much what each man knows about what confronts him as it is what he does about it, and thus the warning that, with the railways on the "spot," committed to adequate and efficient service, come what may, it is time that their "house" be put in order to meet winter conditions, if it is not already in order, and that to fail to do so may court disaster. Maintenance of way men have built up an enviable record in recent years for meeting their added responsibilities during the winter. With the increased importance of keeping traffic moving during the months immediately ahead, they must not fail.

Who's Who in Railroading

HAVING received numerous inquiries concerning the announcement of a publication entitled "Who's Who in Transportation and Communication," we take this means to advise that this book is not being published by the Simmons-Boardman Publishing Corporation, publisher of *Railway Engineering and Maintenance* and "Who's Who in Railroading." To avoid any possible misunderstanding, we announce that we will shortly undertake the revision of "Who's Who in Railroading," which we have published at intervals since 1885 and the last or ninth edition of which appeared in 1930, in order that railway men may have the most complete and authoritative information available regarding the careers of more than 4,000 leaders in the railway and railway supply industries.

This Difficult Side-Hill Slide Condition Was Overcome Completely by Adequate Subdrainage

Stabilizing

Every maintenance of way man recognizes immediately the effects of unstable roadbed, but it is not every one who recognizes as readily the causes for such roadbed conditions and how to correct them. This paper, therefore, presented before a meeting of the Maintenance of Way Club of Chicago, in which the author discusses primarily the various types of water conditions which are involved in roadbed soft spots and how to overcome them, is a valuable addition to the literature available on this subject

THE history of railroad construction has been largely one of attempting to support increased loads through greater surface strength. The prevailing idea has been to increase the strength of the rail and to install better ties and more ballast. While such improvements have been successful in some cases, satisfactory results have been obtained only where the more favorable subgrade conditions have prevailed. Experience has demonstrated clearly that adequate foundation support is necessary if grade and alignment are to be maintained at reasonable cost.

Avoid Excess Moisture

Lack of bearing power in most soils is due to an excess of absorbed moisture. Within certain moisture limits, even clays and silts will furnish satisfactory support, but in the presence of an excess of moisture their bearing power becomes almost negligible. The problem of preventing subgrade soils from becoming unstable by the absorption of excess water is a subdrainage problem.

Subdrainage has been practiced in this country for more than half a century with widely varying degrees of success. The inconsistent results obtained from installations under seemingly like conditions has naturally created a lack of confidence. More recently, however, our knowledge of soils and of methods for maintaining their stability by the removal of excess ground moisture has placed subdrainage on a more scientific and dependable basis.

Soil Characteristics†

Soil stability in the presence of moisture depends upon such physical properties as internal friction, cohesion, plasticity, volume change, soil texture, moisture-retaining capacity, capillarity and rate of percolation. Plasticity is related to cohesion and in soils is controlled directly by the amount of water contained. Volume change is a term used to indicate the expansion and contraction (shrinkage) of soils as the water content changes. The texture of a soil is shown by the range and volume of grain sizes composing the soil.

The moisture-retaining capacity is controlled largely by the texture of the soil. Coarse sand, with its large void spaces, has small capacity so that it holds only a small amount of water above the water table level. Clay, with its fine capillaries and large void ratio, holds a large amount of water.

Capillarity is the movement of water or the absorption of water into a soil through the capillaries or hair-fine openings between the grains of the soil. It takes place in all directions regardless of gravity.

Percolation is the movement of water through soil, caused by gravitation. It is influenced greatly by the friction of the water as it flows through the porous soil. This friction increases rapidly as the pores decrease in diameter until the pores become so small that the capillary tension becomes greater than the force of gravity. Soils containing more than 70 per cent of clay are practically non-percolating. The colloidal content of the soil seems to be the potent factor. It has a greater influence upon expansion and shrinkage, upon the moisture equivalents, and upon percolation than any other of the soil fractions.

Chemical Composition††

The chemical composition of the colloids contained in clay soils have a distinct effect on the thickness of the moisture films or the amount of water absorbed. Colloids high in silica absorb thick films and their volume undergoes great changes upon wetting

*A paper presented before the Maintenance of Way Club of Chicago.

†From F. H. Eno, Research Professor of Highway Engineering, Ohio State University.

††From Bureau of Public Roads on Soil Stabilization.

the Roadbed Through Subdrainage*

By H. E. COTTON

Drainage Engineer, Armco Drainage Products Association

and drying. Iron and alumina colloids absorb thin films of moisture and therefore undergo little volume change upon wetting and drying.

Application of Soil Science

In the present-day construction of earth structures, such as roadbeds, the engineer must employ the available knowledge of drainage and soils to insure a stable structure. In other words, he must use foresight to determine what is necessary to obtain stability. In the case of the maintenance engineer, the structure is already built, and frequently hindsight tells him that something was overlooked or neglected in construction. His problem is to do the best possible with the existing structure and he seldom has need for assistance from the soils laboratory.

True, the maintenance engineer should have a basic knowledge of soils and appreciate that water causes their instability. He must keep in mind two kinds of ground water, (1) free water (gravitational), and (2) capillary water. The source of capillary water is from a free water zone. Capillary water cannot be drained, so it must be controlled or eliminated by removing the free water.

Ballast Pockets

Gravitational water is one of the most common and most serious threats to railway subgrades and embankments. Surface water from rain or snow percolates through the ballast to the subgrade soil. If the soil is clay or silt, the free water does not pass through, but is absorbed by capillary action. The soil becomes unstable and is displaced by the loaded ballast, eventually forming a W-shaped depression under the track. Every track man knows the symptoms when mud is pumped up through the ballast.

Ballast pockets have been known to exist to depths of 10 to 15 ft. Millions of dollars are invested in ballast buried in the subgrade of railroad tracks. This expenditure is not only largely wasted, but the "disease" becomes worse as the size of the water pocket increases. These depressions have in some cases so increased in size that enough water is retained to cause bulging and sloughing of the embankment.

The solution for such conditions is rather simple, and yet many mistakes have been made. Drains must be placed at the lowest level of these pockets to draw off all free water rapidly. Free water follows along the line of least resistance, and if given a free outlet through drains, no appreciable amount of it will be absorbed by the underlying soil, which will soon become stable.

The fallacy of using french drains (rock-filled trenches without pipe) is that the escape of the free water is not free or fast enough to prevent absorption of moisture by the underlying clay soil. Another mistake which has been made is the placing of corrugated metal pipe in the ballast *above* the bottom of the pocket. This does not correct the disease at the bottom of the pocket and the ballast continues to settle, carrying the pipe with it. Pipes installed in this manner have been known to become U-shaped under the track.

Thorough Investigation Necessary

It is evident, therefore, that if a complete cure of wet ballast pockets is to be effected, a thorough preliminary investigation must be made. For the usual type of ballast pocket conditions, the profile of the bottom of the pocket should be determined, both laterally and longitudinally. Once the actual conditions are known and plot-

This Wet Section of Soft Track Was Completely Stabilized by Installing Side-Ditch Subdrainage

ted, the proper number and the most efficient location of drains can be made with reasonable accuracy.

Natural Ground Water

Wherever free ground water exists to cause damage to the track or to other structures, it should be removed. Before a drainage system is designed, a thorough inspection should be made to determine the location and depth of the free water zones. Also, in some cases, the characteristics of the soil should be studied. Such investigations form the only basis upon which the locations and depths of drains and their proper construction can be determined intelligently. Investigations made during wet seasons or soon thereafter are advisable because the worst conditions can then be seen. Free ground water may not exist during a long dry season but may be in abundance at other times.

Along railroads, free ground water can be seen in the form of springs and seepage flowing from the faces of cuts. It can also be detected in the soil when making test holes with a soil auger. Although the upper soil may be very wet with capillary water, no water can be seen on the sample at this level but when the auger reaches the free water zone, water can be seen on the soil sample and generally shows in the auger hole. Free water can be removed from the soil by drains, while capillary water itself cannot.

Ledge rock and other similar conditions complicate the problem of drainage not only in making suitable installations but also in making investigations to locate the water. Regardless of the difficulties involved and the expense of the investigations, however, the locations and depths of drains should not be guessed at.

Free Water Classified

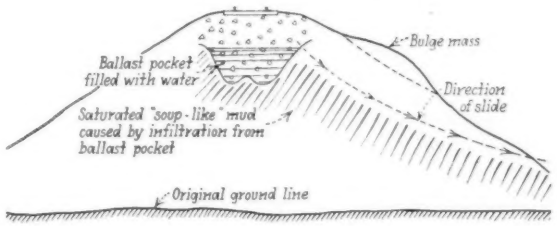
From the standpoint of subdrainage, free ground water conditions may be divided into two classes: Side hill seepage and a level water table. This arbitrary division is made because subdrainage must be handled differently for each class.

The sidehill seepage is found in slightly rolling, hilly and mountainous country. Probably more than 90 per cent of the surface of the United States can be included under one of these classifications. Free water zones are, in general, approximately parallel to the ground surface and, therefore, most of these zones have a slope and may be termed "sidehill seepage zones." Sidehill seepage zones very often function under a head. This is illustrated by the frequent rise of water above the top of the free water zone when test holes or wells tap such zones.

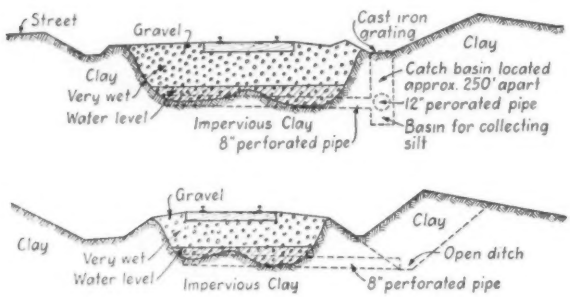
The level water table condition is found in level country and particularly in swampy sections. The free water has little or no lateral flow, but the water table may rise or fall during wet and dry seasons. Capillary water may rise from both sidehill seepage and level water tables.

The sidehill seepage condition is the one most easily drained because outlets are generally available for drains of the required depth. The solution of this problem is to intercept the water before it enters the roadbed area. This requires the proper location and depth of the drains to insure that all damaging water is shut off.

The proper solution in the case of a level water table is to lower the water table below the effective capillary rise limit. The effective capillary rise (a sufficient amount of water raised to cause damage) for each soil class has not yet been established definitely by soil scientists, but for the usual soil it is felt that drains five to six feet below the roadbed surface will be effective. The difficulty in draining level water table conditions successfully is that outlets for deep drains are seldom available.


Bulge mass
Ballast pocket filled with water
Direction of slide
Saturated "soup-like" mud caused by infiltration from ballast pocket
Original ground line

Showing How Water-Filled Ballast Pockets in Embankments Cause Slides



Typical Water Pocket Conditions Found on the Fort Wayne Branch and Method of Drainage with Corrugated Perforated Pipe

Intercepting Drains

Because of the importance of drains, every precaution should be taken to obtain their maximum efficiency and their longest possible service life. In this connection, experience has shown certain features to be advisable in installing intercepting drains. The three most important of these are:

(1) Place drains below the seepage zone and into the impervious zone. (There are some exceptions to this rule.)

(2) A finely graded pervious backfill.

(3) A sealed top.

The purpose of the intercepting drain is, as the term implies, to stop and collect the lateral flow of water. The hydraulic principle employed here is that water follows the line of least resistance. The water drops vertically in the pervious backfill (gravel, crushed rock or similar material) to the bottom of the trench and then enters the pipe because that is the line of least resistance.

To insure complete interception and collection, the drain pipe should be placed in the impervious zone. The placing of pervious material under the pipe is advisable in the case of trenches with soft bottoms, where muck or other runny material may tend to enter the pipe or clog the openings. In no case should there be an attempt to establish a subdrain beneath the drain pipe. For extreme cases of quicksand or similar conditions, the placing of straw or coarse hay under and possibly around the pipe is advisable. In some sections of the West, tumble weeds have been used instead of straw. The life of the straw is probably not long measured in years, but it will suffice until conditions are stabilized.

Finely Graded Backfill

A comparatively finely graded pervious backfill should be used about and over the pipe for two reasons. In

some instances, especially where surface water enters at the top in considerable volume, there is a tendency for the water to cause erosion on the sides of the trench and to wash the soil to the zone around the pipe. A finely graded pervious backfill lessens the vertical velocity of the water, and, therefore, reduces such erosion. The cost of such backfill is usually less than that of one-inch to three-inch screened gravel or crushed rock, which has usually been specified. Very often bankrun gravel is available, which approaches the suggested specification. Also, waste screenings from road construction materials are suitable and frequently available.

The engineer's conception of the need for coarse backfill materials is handed down from the so-called French drain type of construction, where no pipe is used and where lateral flow is dependent upon large voids. Construction and tests have proved that the finely graded material has more than ample downward carrying capacity, and that the drain pipe takes care of the lateral flow of the water in a much more efficient manner than any French drain.

Seal Top

The third important precaution is that of a sealed top to prevent the entrance of surface water which may carry silt and sand and thus clog the pervious backfill. The material used for sealing may be of clay or an artificial mixture in which asphalt or other materials are used to obtain imperviousness. If a material is used which may filter down into the gravel backfill, a layer of straw or coarse hay is advisable.

Ordinarily, it is advisable to remove surface water by means of gutters and catchbasins or inlets rather than down through the pervious material of the intercepting drain. If the subdrain pipe is properly designed for size and stability, it may receive surface water from the inlets, but consideration in this regard should be given to possible silting up due to a lack of self-cleaning velocity.

Sidehill Seepage

The sidehill seepage condition is the one most commonly encountered. In some cases the seepage zone is close to the surface and less than six inches thick, but usually it is found to be three feet or more thick. Under these conditions, the damaging agent is capillary water, which causes an unstable subgrade or frost heave. The solution here is to place an intercepting drain on the upper side of the roadway to shut off the free water completely before it enters the roadbed area. On new construction, the decision as to whether a drain is needed is based necessarily on the depth to the free water zone and the capillarity of the soil above that zone. Where the seepage zone is thick and the bottom is more than seven feet below the roadway surface, the depth of the drain will be governed by the capillarity of the soil above the water table. The pervious soil in the seepage zone should be checked, but it will probably have rather low capillarity, and a drain about six feet deep will probably be effective.

Free outlets are very important. Failure of subdrains to function properly can often be attributed to plugged outlets. It should be the duty of maintenance men to see that all subdrain outlets are kept open. However, a better and surer procedure is to construct the outlets so that they cannot possibly become stopped.

When a pipe line is ended at the top of a slope, outlets frequently become completely covered over with earth washed down from above. Outlet pipes projecting from filled slopes and suspended above the ground surface are an excellent type, especially in the more northerly climates, because of snow. Screens over the outlets are advisable to prevent animals from entering and building nests.

The high train speeds of today make the elimination of unstable subgrades of great importance. Safety, comfort to passengers and decreased cost of repairs and replacements on rolling stock and train equipment are important items. Considering track maintenance only, satisfactory drainage invariably proves its economic value by a large margin. An example of such saving was given in an article entitled "Drying Up the Roadbed," published in the Railway Age of November 9, 1935. The following is quoted from that article:

"The worst condition on this line existed between Richmond and Adams, Ind., a stretch of approximately 86 miles. Here, in generally flat territory, the track is supported on a subgrade consisting largely of blue clay which is highly impervious and of low stability when wet. The ballast consisted chiefly of cinders and gravel. A careful investigation of conditions in this territory showed that altogether there were approximately 27,000 ft. of soft track and that approximately 95 per cent of it was caused by water pockets, or water trapped in the subgrade. The investigation also brought to light most forcefully that the extra work required to maintain this soft track in a safe condition was costing approximately 75 cents a foot a year, seven to eight times the cost of maintaining normal dry track in the same territory, or a total excess maintenance cost of approximately $20,000 a year." One of the accompanying illustrations shows typical cross sections of the conditions found on the section of track between Richmond and Adams.

Nearly every railroad has important track mileage badly in need of such corrective measures. More and more maintenance and operating officers are giving consideration to drainage as a means of obtaining safety and economy. The railways cannot afford to be without adequate and properly installed subdrainage.

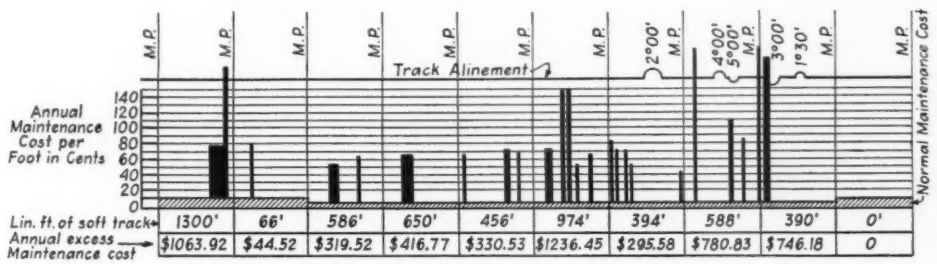
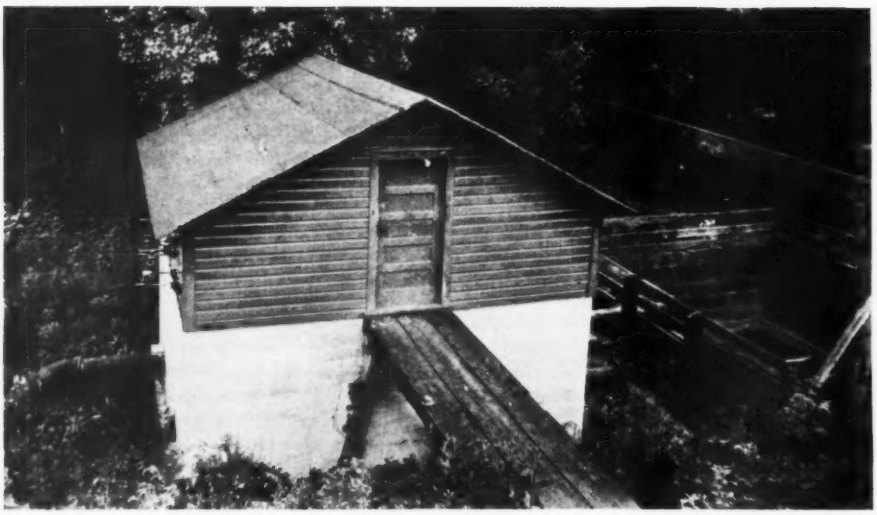


Chart Shows Excess Track Maintenance Costs for Soft Track

Section of Chart Prepared of Soft, Wet Sections of Track on the Fort Wayne Branch, Showing the Lineal Feet Affected Per mile and the Excess Track Maintenance Cost Yearly Before They Were Drained. Note: Total Footage of Soft Spots in 86 Miles, Richmond, Ind., to Adams, 27,054 Ft.—Total Excess Maintenance, $20,317



51

The Pump House and Suction Well (at the left) of the Automatic Motor-Driven Pumping Installation at Andrews Yard, Columbia, South Carolina

During the last five years the Southern has carried out a far-reaching program for reducing water costs, which has involved the installation of 51 automatic motor-operated pumping stations, the abandonment of 46 other stations, and the drilling of deep wells at certain locations to make the railroad independent of municipal supplies. The details of the program, together with figures showing the savings effected, both in the aggregate and at individual locations, are given in this article

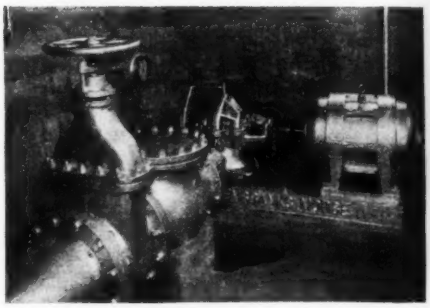
SINCE 1934 the Southern has conducted an active and comprehensive program for reducing the cost of locomotive boiler water, the principal feature of which has been the installation of automatic electric pumping equipment to replace steam-operated and, to a lesser extent, oil-engine-powered pumping stations. Under this program 51 automatic pumping stations have been installed to date at a total cost of $91,933, which are netting the railroad an aggregate annual saving of $66,489, or a return of 72 per cent on the total investment. These savings are based on actual operating costs and include maintenance and interest charges on the new equipment. Prior to undertaking the program, the railroad had 24 automatic pumping stations in service, which had been installed over a period of years, and as a result of the program it is now operating 75 such plants. While the program as originally conceived is substantially complete, it is expected that further installations of motor-operated pumping equipment will be made from time to time in the future as opportunities for effecting substantial economies become apparent.

Many Stations Retired

Another phase of the Southern's program for reducing water service expenses has embraced the abandonment of existing plants wherever local and operating conditions make this possible, and as a result of this phase of the program 46 water stations have been retired during the last six years. In a third phase of the program considerable savings have been realized through the drilling of deep wells at certain locations where the company had previously relied on municipal supplies. When the railroad first began to obtain its water from the cities at these locations the rates were sufficiently low to justify this practice. Now it appears that the city rates have, in certain instances, been raised to the point where the railroad can effect substantial savings by establishing its own sources of supply, and this has already been done at seven locations by the drilling of deep wells and the installation of motor-operated pumping equipment.

Typical Savings

A measure of the economies that are being realized in this manner is provided by the fact that at one of these locations the net annual saving amounts to nearly $10,000. Other locations are under investigation where water is purchased from municipalities and where dependable creek supplies are not available, and it is expected that further deep-well installations will be made at some of these locations, providing that such supplies prove adequate and of good quality and that savings can be effected thereby.



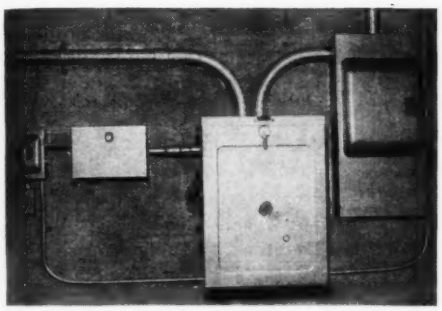
Within the Pump House, Showing the Close-Coupled Motor and Pump, and the Gate and Check Valves

To illustrate the extent of the savings that have been effected as a result of the electrification program, the results at five locations, selected at random, are given in the accompanying table, which shows the cost of making the installation at each location, and the annual savings, expressed both in dollars and as a percentage of the investment. The significant aspect of this table is that at none of the locations listed—and they are typical of all the installations—does the annual return on the investment amount to less than 40 per cent.

Statement of Costs and Savings at Typical Installations of Automatic-Electric Pumping Equipment

Location	Cost to Install	Net Yearly Saving Amount	%
Varnell, Ga.	$1,259.44	$1,033.00	82
York, Ala.	2,221.03	987.00	44
Andrews Yard (Columbia, S.C.)	5,660.28	2,250.00	40
Appalachia, Va.	1,398.03	874.00	63
Bridgeport, Tenn.	3,560.71	2,001.00	56

Automatic Pumping Plants Earn 72% Return



Automatic Control Is Achieved by Means of Magnetic Switches Which Are Mounted in the Pump House

A typical example of the deep-well installations is that at the Coster shops near Knoxville, Tenn. This well is 610 ft. deep and the installation consists of a turbine pump operated by a 30-hp. motor and having a capacity of 300 gal. per min. With this installation the railroad is saving $9,895 a year (a return of 111 per cent on the investment), as compared with the cost of obtaining water from the city system. The comparative monthly costs, including a breakdown of the operating charges for the deep-well installation, are given in the following:

Cost of city water per month		$993.28
Monthly operating cost of automatic electric pump at deep well:		
Inspection	$10.00	
Electric current	82.59	
Oil and waste	2.00	
Maintenance and depreciation	29.64	
Interest on investment	44.46	
		$168.69
Monthly saving		824.59
Annual return on investment		111.2%

The Southern first began to replace steam and oil-engine-operated pumping stations with automatic motor-operated equipment in 1925, although these early installations were not made in accordance with a definite program and by the early 'thirties, as stated at the outset, only 24 of them had been placed in service. Experience with the automatic equipment in these installations demonstrated its dependability of operation and also that substantial economies could be realized, sometimes amounting to 100 per cent or more annually on the investment. In view of these facts, therefore, the management came to the decision in 1934 to proceed with additional installations in accordance with a definite program, and as rapidly as the necessary funds could be made available.

Preliminary Survey

Before any installations were undertaken, a survey was made of the company's water stations to determine which of them embodied the qualifications or conditions that were deemed essential before electrification could be considered as being practicable or as offering the desired economies. Obviously there were a considerable number of steam plants that did not fall into this category. Some of them embodied treating plants that required manual attendance anyway, while others were operated by pumpers who handled several plants or by agents who were paid a nominal amount for their efforts in this respect, and in such instances the advantages of automatic control for pumping facilities do not apply. At other locations electric power was either not available or its cost was found to be too high to permit of the desired savings. Also there were instances where, because of the characteristics of the stream from which the water was obtained, the supply was not considered sufficiently dependable to permit the operation of the plant without manual attendance.

For the purpose of obtaining the necessary data for determining what water stations could readily and profitably be electrified, the engineer of water service issued a questionnaire to the divisions requesting such information regarding each station as to the type and condition of the existing pumping equipment, the daily consumption of water, the itemized gross cost of installing and operating automatic electric pumping equipment, the monthly cost of operating the existing station, and the estimated monthly saving that would follow the installation of the electrified equipment, giving consideration, of course, to interest and depreciation charges. As conditions attached to the survey, it was stipulated that all stations where the estimated saving was not at least 15 per cent were to be excluded from consideration and, furthermore, that the suction lift was not to exceed 10 ft.

As a result of the survey, a total of 43 water stations were chosen for inclusion in the program of electrification, including 34 steam-driven plants, 8 stations driven by oil engines and one air lift which was also powered by an oil engine. Subsequently eight additional stations were added to the list, thereby raising the total to 51. As a measure of the range in the size of the plants that were chosen for electrification, it is interesting to note that the daily consumption of water at the 51 locations varies from 12,000 to 480,000 gal.

Obviously the installations that were made at the various locations embody variations in details to adapt them to the local conditions but, in

general, each installation embraces a close-coupled type motor-driven centrifugal pump with flange connections, which is installed in the existing pump house, with the old pump retained as an emergency or standby unit. At a few of the more important locations, where the steam plants were not considered satisfactory for standby service, duplicate sets of motors and pumps were installed, with one of them serving as the emergency unit.

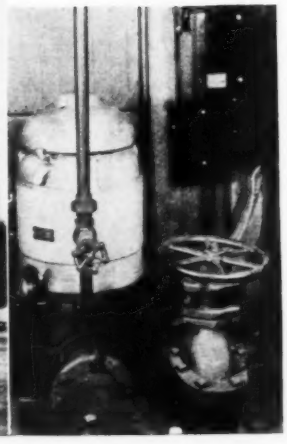
At locations where the single motor-driven units are installed, a separate suction line is provided for the new pump and the discharge from this pump is connected with the present discharge line, employing the necessary check and gate valves. To preclude the necessity of using long suction lines, a gravity line of reinforced concrete construction, is usually laid between the creek and a suction well, near the pump house. This type of installation permits the use of a suction line only 12 ft. long.

One of the stipulations governing these installations is that the level of the water in the suction well should be at least 3 ft. above the foot valve and in a number of instances dams have been constructed across the streams to fulfill this requirement. In the beginning, some interference with the proper functioning of the plants was occasioned by the clogging of the intake and foot valves with leaves and other debris, particularly during the fall of the year. To prevent such occurrences, special screens are now used which are placed at the intake end of the gravity line in the creek, at the other end of the same line where it enters the suction well, and, in addition, on the foot valve.

Other Details

In nearly all of the installations the automatic pumps have been placed at a level below that of the steam pumps to reduce the suction lift, and in such instances automatic sump pumps are installed in the pump pits for removing the water that drips from the water-seal gland. Where such protection is considered necessary, the pumphouses were insulated and small electric heaters were installed as a precaution against the freezing of the pumps and pipe lines.

The motors used in these installations range in size from 3 hp. to 50 hp. They are ball-bearing mounted and are all provided with overload protection. In all cases automatic control is achieved by means of magnetic switches in the pump house, actuated by floats in the storage tanks. Wherever conditions will permit, electric power is obtained from the railroad's signal circuits, but installations embodying this arrangement are limited to locations where the capacity of the pump motor does not exceed 5 hp. Where the power is derived from signal circuits, compensator-type starters are used on the motors, while at other locations, that is, where the power is obtained from commercial sources, across-the-line starters are generally used.



Left—The Pump House and 100,000 Gal. Storage Tank of the Deep-Well Installation at Coster Shops, Knoxville, Tenn. Below—The Discharge Side of the Turbine-Type Pump Employed

Standardization Not Favored

Some consideration has been given to the possible advantages that might accrue through the adoption of a few standard sizes of pumps and motors for the automatic installations but, while such a policy would make it possible to hold to a minimum the number of spare parts that must be kept on hand, it is regarded as having a number of serious disadvantages. For instance, it is not considered good economy to attempt to use the same size of pump and motor for a variety of operating conditions as this would mean the installation in some instances of motors larger than are necessary to handle the load. The result obviously would be the imposition of a motor demand charge somewhat higher than that which would prevail if a smaller but adequate motor were installed. Also it is pointed out that centrifugal pumps are designed for certain heads and that to install such pumps under heads other than those for which they are designed would have an adverse effect on their efficiency and would be uneconomical.

Maintenance and Repair

The periodical inspection of the automatic stations is placed in the hands of the local track and signal forces and the division pump repairmen. Each signal maintainer is instructed to inspect the electrical equipment at each automatic installation on his territory about every three days, giving attention to the motors, switch boards, contacts, float switches and resistance units.

All mechanical parts of the pumping installations of a non-electrical nature, such as the pumps, pipe lines and valves, are inspected periodically by the pump repairmen. These employees also renew the lubrication of both the pumps and motors, and advise the signal maintainers of any defects or maladjustments in the electrical equipment that they may encounter during their inspection. Also daily inspections of the automatic installations are made by the section forces, which give particular attention to the condition of the pipe lines and valves and to the level of the water in the storage tank, while any debris that may have accumulated around the intake screens is cleared away. Any electrical defects

(Continued on page 763)

Scheduling Work Equipment

What Is Good Practice?

That there are many differences of opinion regarding the manner in which work equipment should be scheduled is revealed in this abstract of a report that was presented at the convention of the American Railway Engineering Association by a subcommittee of the Committee on Maintenance of Way Work Equipment, of which C. E. Morgan, superintendent of work equipment and track welding, of the C. M. St. P. & P., Chicago, was chairman

SCHEDULING the use of work equipment to the end that it will be in service the maximum number of working days during the year is necessary if full utilization is to be made of the money invested in such equipment. Railway men are becoming increasingly conscious of the importance of securing the highest quality of output at the lowest unit cost in carrying out maintenance tasks, and one of the methods by which this end can be furthered is to schedule the use of work equipment. The following list of maintenance tasks is typical of those that may be scheduled successfully:

Distributing rail	Widening banks
Laying rail	Welding rail ends
Picking up rail	Heat treating rail ends
Changing angle bars	Renewing ties
Tightening bolts	Bonding rail
Ballasting track	Burning weeds
Cleaning ballast	Spraying weeds
Ditching	Scarifying
Driving piles	Discing.

Many different systems of scheduling work equipment are in use, some of which place all the authority in a central office while others allow each division to handle all its own equipment. In order to obtain a summary of prevailing thought regarding this subject, a questionnaire was sent to the members of the committee, in which they were asked to indicate their opinions regarding whether different machines should be assigned on a system, regional or divisional basis or by the supervisor. The ideas of 20 men, representing 16 roads having an aggregate of about 99,000 miles of railroad, were obtained and are shown in the accompanying table. The figure in each column indicates the number of men who are of the opinion that the machine in question should be assigned to the territory shown.

It will be noted that there is quite a diversity of opinion as to how the machines should be assigned. This can be explained by the different conditions affecting the work to be done. Among these are (a) organization, both of gangs and supervisory forces; (b) climatic conditions; and (c) the extent to which maintenance activities are mechanized.

Preliminary Studies

As an illustration of what is being done in the way of scheduling work equipment, the remainder of this report is based on the practice of a large railroad, quite fully mechanized, on which the distribution of men, materials and machines is under the control of a single department head. Under less favorable conditions, as, for example, where there is a shortage of machines, the results obtained may be less satisfying; but in this case the need for scheduling the work and the machines, in order to secure full utilization of the available equipment, is quite obvious.

In preparation for arranging the schedule for a given season, all the work that is to be programmed is grouped and, after a study of the entire picture, a schedule is prepared in which the output for each working day is based on records of actual performance for previous years. Allowances for loss of time due to adverse weather or the transfer of equipment must be made. After the schedule has been arranged, it will be possible to determine how many machines will be required, how large the gangs should be, what hours must be worked, and, last but most important, whether enough equipment is available to handle the work as outlined. This will require that a study be made of the proper number of men that will be needed in each gang to obtain the maximum efficiency in the operation of the different machines.

The Work of Much of the Equipment of Both the Track and Bridge Forces Can Be Scheduled Effectively

Before any work is authorized, sufficient inspection work should be carried out to permit a comprehensive program to be arranged in such a way as to avoid irregular moves of the gangs and as a means of minimizing delays. This policy will prove effective in holding the men on the job and also in increasing the availability of machines. A thorough inspection will frequently disclose that, where certain work on a specified territory was planned for one year and other work in the adjoining territory would ordinarily be carried out the following year, sub-

stantial savings could be effected by scheduling all the work as part of a single program. The savings effected will frequently compensate for any disadvantages that may accrue because of completion of the work at an earlier or later date than originally contemplated.

If the units of equipment are small and readily portable, they can be assigned to a supervisor for a sufficient length of time to permit him to complete the particular class of work involved and then passed on to the next supervisor who has similar work on his program. The scheduling of such work enables both men to know when to expect the equipment, together with the materials, supplies, or necessary additional labor that may be required.

Climatic Considerations

It is often advantageous to schedule certain work so that the equipment begins the season in areas where spring comes early and moves to colder latitudes as the season advances. Certain north and south roads can schedule work equipment for use in the south in the winter and in the north in the summer, thus providing better working conditions for the men and equipment and getting the work done at the best possible time. This procedure also helps to stabilize employment and to reduce the number of men that must be trained to operate the equipment.

The work of scheduling the operations of a gang using mechanical equipment requires much more detailed preparation than would be the case if no equipment was involved, but when the work once gets under way it moves forward at a uniform rate as the operations are usually built around the mechanized equipment. For this reason it is essential that such equipment be maintained in condition for reliable operation.

Every gang that operates any amount of mechanical equipment must have among its personnel a man capable of keeping the equipment in repair. Where enough equipment is used to justify the expense, an equipment maintainer should be attached to the organization. If the number of machines is small and they are widely scattered, the operator of each unit should be capable of making field repairs. The organization should include an understudy for each operator or repairman, who should be capable of taking over the work in case the regular man is kept away from the job.

Where several machines are operated together as a unit, the productive capacity of the gang must be protected by maintaining on hand such spare parts as engines and transmission units. In cases where frequent field repairs are necessary, complete spare machines are justified in order that the progress of the gang shall not be impaired by a machine failure.

A program or schedule for performing work serves as a notice to the interested departments as to where and when materials will be required. Under such a system materials can be purchased on a quantity price basis and furnished on a spread delivery basis, shipment being made direct from the factory to the different destinations in accordance with the schedule. Also, repairs to machinery can be more readily handled when the schedule shows where the gang will be on any particular date. Work programs laid out as much as six months in advance may be adhered to throughout with variations of only a few days between the schedule and the actual progress of the work.

Conclusions

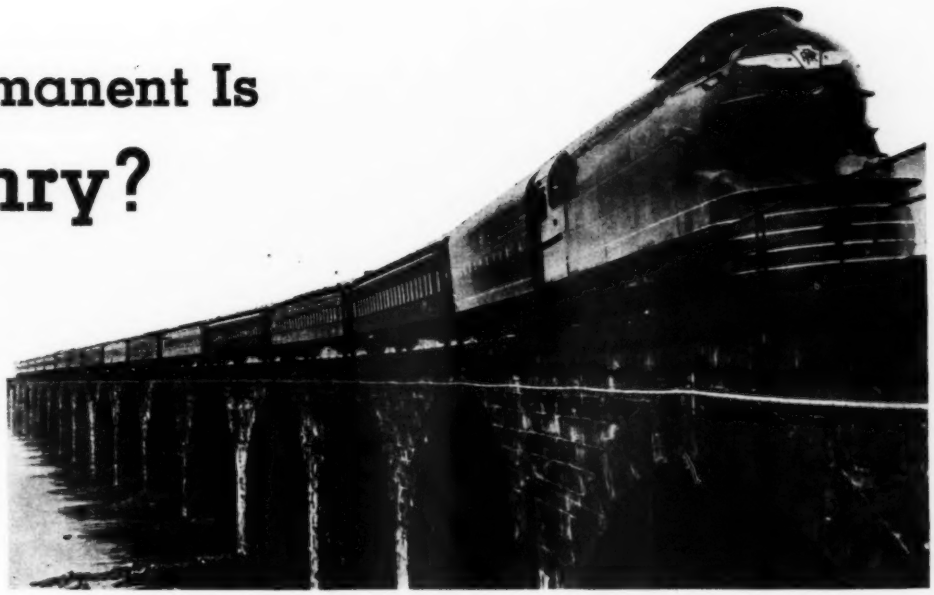
(a) Full utilization of the machines available can be secured only by adhering to a schedule based on studies involving inspections and recommendations covering the work to be done. Geographical location and urgency of the work must be considered. Such a schedule can be followed successfully only where the distribution of men, materials and machines is under the direct control of one department head.

(b) Such a schedule, besides more fully utilizing the available machines, will simplify their maintenance, both in the field and shop, while adherence to it will provide an index to the progress of the season's work.

Tabulation of 20 Answers to Questionnaire Showing Number of Preferences for Each Plan of Assigning Work Equipment

Type of Machine	*System*	*Region*	*Division*	*Supervisor*
Rail layers	8	4	6	2
Rail distributing or pick-up outfits	8	5	4	1
Rail loaders	5	5	7	2
Gas-welding equipment	5	4	9	3
Arc-welding equipment	8	7	5	0
Rail-grinding equipment	5	9	7	1
Locomotive cranes	5	6	10	1
Pile drivers	6	8	6	1
Tie-tamping outfits	5	1	10	6
Crawler shovels and drag lines	6	8	6	0
Ditchers, top car	3	12	4	0
Ditchers, Jordan	4	12	3	0
Motor cars, section	3	0	4	15
Motor cars, inspection	4	3	8	6
Motor cars, heavy duty	4	0	8	8
Weed mowers	6	5	6	1
Weed burners	5	10	3	0
Weed sprayers	7	9	3	0
Power rail drills	2	4	10	3
Rail-adzing machines	7	7	4	0
Spike pullers	8	7	3	0
Power jacks	9	9	0	0
Ballast cleaners	8	8	2	1
Power track wrenches	7	3	10	1
Snow plows, wedge	4	4	9	0
Snow plows, rotary	5	7	7	0
Snow plows, side	5	4	7	0
Snow-cut wideners	5	6	6	0
Hoisting engines	5	6	8	0
Power winches	5	5	7	2
Rail expansion pullers	3	2	6	7
Electric generating plants	7	4	7	2
Paint spray machines	4	1	12	2
Air compressors	3	5	9	3
Concrete vibrators	5	8	5	2
Concrete mixers	5	4	7	4
Concrete busters	4	4	11	1
Wrecking locomotive cranes	4	3	11	1
Stiff-leg derricks	5	5	16	2
Discing machines	4	5	7	1
Spike drivers	8	7	3	0
Full rail oiling machines	10	5	0	1
Joint Oiling Machines	5	8	0	3
Tractors	4	7	8	2
Automobiles	3	2	12	5
Trucks	3	1	13	3

How Permanent Is Masonry?



The Pennsylvania's Four-Track Bridge Over the Susquehanna River Near Harrisburg, Pa., Is One of the Country's Historic Structures

By J. F. LEONARD Engineer Bridges and Buildings, Pennsylvania, Pittsburgh, Pa.

In this paper, which was presented before the convention of the American Railway Bridge and Building Association in Chicago on October 17, the author finds that contrary to any belief as to their permanence, there comes a time in the life of all masonry structures, and especially those carrying railroad loadings, when they must be repaired or strengthened. He then discusses some of the more common causes and types of masonry failures and details of various methods of repair

THIS subject, to some engineers and to a considerable number of railroad officers will seem a paradox and, therefore, completely inappropriate. They have been taught that masonry is permanent.

Webster's dictionary defines "Permanent" as "The quality of being permanent, enduring or fixed perpetualness—as nothing material has permanence." From this definition, it is evident that masonry cannot be permanent in the true sense of the word, and I think most of us know from experience that this is so. But as the result of the way the word permanent has attached itself to the term masonry, we railroad engineers find ourselves constantly being put on the defensive when we try to obtain proper budget authority for the maintenance of masonry structures.

All of us are familiar with the slogan "concrete for permanence" so widely used at one time, and when we find later that we just somehow failed to make our concrete that good, it is a source of embarrassment to ask for the necessary funds for its maintenance. However, in fairness to the coiners of the expression, I feel sure that they did not have in mind its literal or real meaning, but used it only in a relative sense.

Stone Masonry

The design of retaining walls for stability against overturning has long been a more or less accurate mathematical problem, and in the case of monumental arches and piers, a direct stress analysis was generally undertaken. Otherwise, the design of masonry structures has been almost entirely empirical, based largely on past performance and practice, combined with good engineering judgment. I have a high regard for those preceding us who built these structures we are now maintaining. That so many are still standing and serving so well in spite of deferred maintenance is indeed a monument to the wisdom and skill of their builders.

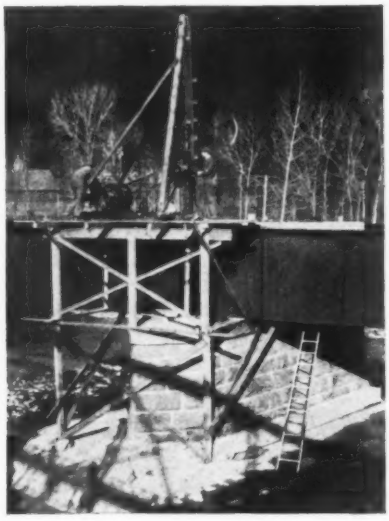
Masonry is not a real monolith, but rather is composed of two parts—the dimension stone and the mortar. Even if the stone has remained in good condition, the mortar often breaks down. Furthermore, masonry structures are elastic, and the constant repetition of strains tends to break down and cause working at the joints between the stone and mortar. This is particularly noticeable in arches and retaining walls where the bond between the two is gradually lost and the movement becomes progressive. In retaining walls, the initial bond between the stone and mortar actually permits tension to be developed in the back of the wall, but this is gradually lost. As a matter of fact, I am convinced that in the case of large numbers of our old masonry structures, the earth embankment in back of them has gradually so consolidated itself over the years that an arching effect has been produced which helps keep them stable, where otherwise trouble might have been experienced long ago.

Another source of our trouble today is the common construction practice of earlier years of using dimension stone for the face only. In the case of arches and walls (and I think of bridge abutments as walls), rubble stone, with or without mortar, was used for backing, and in the case of piers, the core was sometimes of rubble and sometimes of spalls. As a result, the core provided a place for water to collect, with an endless cycle of freezing and thawing in cold climates. I believe the engineer of today recognizes more than ever before the all-important factor of keeping water out of masonry, but in spite of this, few old masonry structures were pro-

vided with a positive drainage system, or at least a drainage system which has been kept positive.

Drainage Necessary

In the past we have inspected masonry structures conscientiously at regular intervals and have pointed the joints, but this has not been an effec-



The Internal Grouting of Old Masonry Piers Has Been Resorted to Successfully in Many Cases

tive cure. If conditions get bad enough, we go in with "crutches" for a while, but finally give up and replace the structure. We will have to continue to do this in some cases in the future, but the poor old railroad pocketbook is so lean that the financial strain of this practice is severe.

There has now developed a school of thought which suggests remedial treatments of not too great expense, which we hope will prolong the life of these old structures very materially. One of these is to install a positive drainage system. This requires a careful survey, developing, if possible, the source of water, and cutting it off. Failing this, there are schemes of what we might call the "cut and try" method; that is, cut in drainage pipe and try to carry the water away. In a number of cases with which I am familiar, this method has been quite successful, the success generally being in proportion to the care and ingenuity which was exercised. In the case of retaining walls and the backwalls of abutments, drain pipes or open ditches at the tops will catch the surface water, and sometimes that will suffice. In the case of arch bridges of the closed spandrel type, longitudinal and intercepting drains have been installed at the sub-grade level to carry away the surface water, and in many cases the improvement resulting has been quite noticeable and often sufficient, at least for a considerable time. And why should this not be done? The track maintenance department recognizes the necessity of well-drained track. If this is necessary on ordinary roadbeds, why is it not just as important to have well-drained track over bridges, which represent so much larger an investment per lineal foot of support?

Pressure Grouting

We have today many old masonry structures where the mortar is badly disintegrated, but where there has never been mortar replacement except in pointing, which, after all, is only at the face of the joint. With the mortar gone, the sharp high points of the stones come into contact, frequently with knife-edge bearing, and then the stone cracks. The only method of which I know to restore joint mortar adequately and thus produce again, in effect, a monolith of the masonry, is by pressure grouting. This is accomplished by drilling holes in the masonry and then injecting cement grout under pressure. The grout used can be any mix from neat cement to one part of cement and three parts of sand —and fine, sharp engine sand is best. Neat cement grout will penetrate into smaller openings and has the further advantage that it can be placed by means of a direct-acting pump. Where a large amount of grout is required,

Liner Plates, Backed with Grout, Have Been Used Recently in Arch Lining Work

pneumatic apparatus is generally adopted as it permits the mixing of the sand with the cement in the gun. In some cases an admixture is used as a waterproofing agent, or to obtain better penetration, or both. For stone arch consolidation work, I much prefer the direct-acting pump method, as it affords complete control at the point of deposit.

In our treatment of old arches, we first generally drill holes all the way through the stone and then try to deposit a layor of grout at low pressure immediately back of the stone against the earth fill, to consolidate the backing and to build up a waterproof envelope. After this grout has been permitted to set, it also serves as a face to pump against in our next operation of attempting to fill all of the mortar joints and cracks in the stone. Furthermore, since we cannot see what has gone on within the structures during the years, it also serves to consolidate and restore any badly disintegrated dimension stone.

In addition to the holes used to place the initial grout, numerous other holes should have been bored for the successive grouting operations, which serve, in the meantime, as observation points to note the progress of the grout. After the backing is deposited, the grouting holes should only penetrate part way into the masonry. Under pressure, the grout finally begins to run out at the joints. Where this occurs, the joints are plugged with oakum or waste, as are also the adjoining drill holes where this may be found necessary.

Structural Lining

In some cases the arch stones themselves have become badly weathered on their faces, deep spalls have fallen out, and the entire structure has become weak. Where failure has progressed this far, various methods of lining have been attempted. The oldest and most common practice has been to build forms under the arch and to deposit a new ring of concrete about two feet thick, cutting a shoulder for it to rest on, or setting it on footing offsets. Dowels are also usually placed into the arch stone. This method has been fairly successful, but it is quite expensive and presents the further difficulty of obtaining a tight joint between the poured concrete and the face of the stone arch. Steel liner plates, instead of wood forms, have been used more recently in arch lining work and have the advantage of considerable arch strength in themselves. Where these plates are used, the backing is generally of grout. Still more recently, substantially reinforced shotcrete has been used for lining. By "substantially reinforced," I mean a balanced design of reinforcing to produce real strength. In other words, if a four-inch thickness of concrete is deemed necessary, then the reinforcement should be—quoting our own practice —½-in. rods on 18-in. centers, paral-

lel with the track and 3 in. from the face of the lining; then 2-in. by 16-in. mesh of No. 1 and No. 7 gage rods, placed 1 in. back from the face, with the No. 1 gage rods at the 2-in. spacing and parallel with the barrel, that is, at right angles to the track. The heavy reinforcement parallel with the arch aids in distributing the load and also holds the arch together against the lateral thrusts of track loads on the parapets. I am firmly convinced that pressure grouting to waterproof and consolidate the arch itself should always precede any form of structural lining.

What has been said with regard to masonry arches applies equally well to retaining walls, abutments and stone-lined tunnels, except that any extraneous lining is not needed or should be handled in a different fashion. In the case of tunnels, the problem is much more complicated and would involve a discussion far beyond the scope of this paper.

For pier masonry, in general, the problem of solidification, so far as the shaft is concerned, is essentially one of straight pressure grouting. In a pier solidified by this method, we forced water out of the core that had been confined undoubtedly for a long time, and subject to freezing at intervals. The actual amount of grout deposited in the pier amounted to about 8 per cent of the cubic contents of the masonry.

Footings

While my discussion thus far has dealt with the consolidation and thus the preservation of the masonry itself, many difficulties have, of course, developed in the behavior of footings and their supports. Each one of these is a particular problem in itself. There has, however, been considerable progress in the consolidation of footings and foundations by means of pressure grouting, particularly for the spread-type of footing, using the grout to consolidate the sustaining soil and thus spread the bearing area. Much valuable literature is available on this subject, but most of it has to do with dam work.

Painting Concrete Surfaces*

By J. P. St. George

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IT IS possible to paint concrete and cement surfaces successfully with linseed-oil paints, provided a few simple precautions are observed. First and most important, it is necessary that the concrete be dry and neutral, since no oil paint can be expected to adhere to or give good results on a surface that contains moisture and free alkali. In many cases, it is possible to allow the concrete to age for nine months to a year before the paint is applied. This will usually give ample time, not only for the concrete to dry thoroughly, but for the natural neutralization of the free alkali contained in the cement.

If the surface must be painted before the natural aging can take place, it is advisable to neutralize the material artificially, and this can be done by washing the surface thoroughly with a solution of zinc sulphate. The addition of two pounds of commercial zinc-sulphate crystals to one gallon of water will make a solution of sufficient strength for the purpose. If there is any doubt as to the condition of the surface, it is easy to make a test by using a phenolphthalen solution. This is a colorless solution which, in the presence of free alkali, turns a deep red. This should be applied at several points on the surface and, if no color appears, it will be safe to apply the paint without treating the surface with the zinc-sulphate solution to neutralize it.

White Lead for Concrete Surfaces

It is strongly recommended that straight white lead be used as the pigment for paints that are to be applied to concrete surfaces. The correct formula for the priming coat is:

100 lb. soft-paste white lead
3 gal. pure boiled linseed oil
2 gal, spar varnish
1¼ gal, pure turpentine

This makes 9⅜ gal. of paint which, if applied properly, should spread about 200 sq. ft. to the gal.

For the second coat, the mixture should be:

100 lb. soft-paste white lead
2 gal pure raw linseed oil
1¼ gal pure turpentine
1 pt. liquid drier

This makes 6½ gal. of paint, that should cover about 400 sq. ft. per gal.

The third or finish coat on concrete surfaces should be flat. The formula recommended for this coat is:

100 lb. soft-paste white lead
1¼ gal. pure turpentine
¾ gal. spar varnish
½ pt. liquid drier

This will make 5⅝ gal. of paint, which should cover about 400 sq. ft. to the gal. The best quality of varnish that it is possible to obtain should be used in this formula.

If a gloss finish is preferred, the following formula should be substituted for the one already given for the finishing coat:

100 lb. soft-paste white lead
3 gal. pure raw linseed oil
1 pt. liquid drier

This formula will make about six gallons of paint, which should cover about 600 sq. ft. per gal.

In many cases colored finishes are preferred to white and these can be obtained by adding tinting materials to any of the foregoing formulas, to produce the desired tint. The flat coat for which a formula was given is used for both interior and exterior surfaces. The gloss coat produced by the foregoing formula is suitable for outside work only, for it has been found that the full liquid-oil formula tends to yellow in a displeasing manner when used on the interior.

It should be understood that the spreading values that are given with the formulas are intended as averages only, and considerable latitude must be allowed for paints applied to concrete surfaces. These surfaces vary so widely in texture and degree of porosity that no fixed value can be given for the coverage of the paint. On very rough surfaces, for example, the spreading rate may be considerably lower than that given, while on exceptionally smooth concrete surfaces the spreading rate will probably be somewhat greater than stated.

For a Flat Finish

There is a special type of vehicle, called lead mixing oil, that greatly simplifies the preparation of paints for use on concrete and cement surfaces. This is a vehicle which, as its name implies, is intended for use with white lead. It produces a paint that dries to a hard, durable, easily-cleaned, flat finish. It contains the proper amount of binder, volatile

*This discussion was submitted for publication in What's the Answer department of the September issue, in reply to a question as to the practicability of painting concrete surfaces with linseed-oil paints. Because of its comprehensive character, it was withheld for presentation here as an independent article. For further discussion of this subject, see page 539 of the September issue.

thinner and a sufficient amount of drier to make it a complete vehicle. It is used in accordance with the following formula for the priming coat:

100 lb. soft-paste white lead
2½ gal. pure boiled linseed oil
2½ gal. lead mixing oil

This will make about 8 gal. of paint which, when applied properly, will spread over about 200 sq. ft. to the gal., and will provide a thoroughly satisfactory sealing of the surface.

Where a flat finish is desired, the second and finishing coats may be based on the following formula:

100 lb. soft-paste white lead
3 to 4 gal, lead mixing oil

This will make from 6 to 7 gal. of paint which, for the second coat, should cover about 400 sq. ft. to the gal.; and for the finishing coat, about 600 sq. ft. The resulting flat finish is durable, pleasing in appearance and is considered quite appropriate for both exterior and interior concrete surfaces.

Keeping the Cost Down

In some cases it is desired to keep the cost of the first painting as low as practicable and to repaint at somewhat frequent intervals for the sake of appearance. For such work a two-coat job may be satisfactory for the first painting and, if this is decided on, the priming and second coats, based on the lead-mixing-oil formulas, can satisfy the requirements. In this case, if tinting is desired, it is customary to add colors-in-oil to the priming coat, as well as to the second coat. On three-coat work, the colors are usually added to the second and finishing coats only.

Much of the work that confronts the maintenance forces is that of repainting. If the concrete surfaces have been painted properly, and the paint is in good condition, it is usually sufficient to dry-brush the surface and apply two coats of paint mixed according to the formulas given for the second and third coats. If, however, the old paint is in bad condition, from either blistering or cracking and scaling, a good wire brushing or sand blasting should be resorted to, to remove all of the loose paint. The unpainted spots should then be primed and, after the primer has dried, the entire surface may be given two coats of paint. If water paint was used on the surface originally, it should be removed as thoroughly as possible, and the surface should be given three coats of paint, as recommended for new, unpainted surfaces.

How to Remove a Tie*

By George S. Crites,

Division Engineer
Baltimore & Ohio, Punxsutawney, Pa.

THE renewal of ties is an art; when well done, material is conserved, the track is improved and future maintenance is reduced. There is probably no other routine operation connected with track maintenance in which so much money can be wasted or saved as that of selecting the ties to be renewed and its corollary, the actual renewal. In the first place, the necessity for renewals must be determined by taking traffic requirements into consideration and by inspecting every tie to determine the degrees of wear and decay, not only for the particular tie under consideration, but with respect to adjacent ties. One who is familiar with the traffic on the line and with the requirements for track, and who has a well-balanced conception of economy should mark the ties for renewal.

Methods To Be Followed

When the selection of the ties that should come out has been made, the ties may be renewed by digging them in without raising the track or by slipping them in while general surfacing is in progress. For scattered renewals, the former method is undoubtedly the best, but if the renewals are heavy the latter will usually be more economical. If the track is scheduled for a general surfacing, the ties should be renewed in connection with this work, whether the renewals are light or heavy, but no attempt should be made to "slaughter" the old ties merely because the raising of the track facilitates the insertion of ties. Track that is raised will give a more even support for the ties than track that is allowed to remain on its old bed, with the ties that are renewed dug in.

When train speeds are high, uniform spacing of the ties is essential for the maintenance of good-riding track. Treated ties are expected to remain in place for many years, for which reason it becomes more important that when a tie is inserted it be in its proper place and not just dragged in wherever the old tie happened to be. The correct spacing of the ties during a general raise can be done readily by marking the rail panels for the tie spacing, and similar marking of the panels when ties are dug in will be of material assistance in keeping a reasonably uniform spacing for the ties. Some responsible person should be delegated to check the tie spacing when renewals are being made.

Making the Renewals

After the decisions based on these preliminary considerations have been made and the ties that are to be renewed have been checked and marked, and the proper location for the ties has been found, the new ties should be distributed conveniently to the place where they are to be used. When renewing a tie in track that is not to be raised, the ballast on the side of the tie nearest to the location for the new tie should be removed only to a depth that will permit the sliding of the old tie sidewise for removal. Following the cribbing, the spikes are drawn from the old tie, one at a time. Each rail is then jacked up at the same time to get the plates off the old tie and to loosen it so that it can be removed. This operation follows the cribbing, and train schedules will govern the time that it should be done in advance of the insertion of the new tie.

After the old tie is out, the bed for the new tie should be dressed down enough to allow the new tie to be drawn into place without raising the track. The more neatly this can be done, the better the bearing will be for the new tie. Judgment must be used with respect to getting the correct amount of ballast under the new tie, so that when the plates are placed and the tie is under traffic, it will be tight enough to carry all of the load it should bear, and not allow an excessive load to be placed on the adjoining old ties. Track in which the bearing for the new ties is too tight or too loose will ride bumpy. If the ties are too tight the riding qualities of the track will become progressively better with no attention, but progressively worse if the ties are

*This discussion was submitted for publication in the What's The Answer department in answer to a question as to what sequence should be followed in removing a tie for renewal and in inserting the new tie. Because of its comprehensive character it was withheld for presentation here as an independent article. For further discussion of the subject, see page 422 of the July issue.

too loose and are not attended to.

If the track is to be raised, the selection and marking of the ties should be done with the same care as when the ties are to be dug in. In this case also, the rail panels should be marked before the new ties are distributed, so that extra ties that may be needed can be unloaded where they belong.

Spacing the Ties

Where high-speed or heavy-traffic tracks are to be given a general surfacing, all of the ties should be spaced ahead of the tampers, and all ties must be tamped to a uniform bearing. If tie tampers are being used, the ties that are to be renewed should be tamped on the ends only, the idea being to have the track supported securely and uniformly at all times. Behind the tampers, and preferably after the traffic has settled the raised track, the ties to be renewed are slipped out and the new ties inserted under the same procedure as when they are dug in. In this way, the renewals can receive the careful personal supervision of the foreman, with the knowledge that his track is safe for prescribed speeds at all times.

When traffic regulations are very exacting, it may be necessary to dig the ties in ahead of the raise, but this is more difficult and expensive, since the ballast in the cribs is undisturbed. There is also a tendency to slight the spacing of the ties when they are dug in in undisturbed ballast, this being especially true when there are too few ties in one panel, and perhaps too many in the next one.

On Light-Traffic Lines

On light-traffic lines, where the surfacing lift is done under full flag protection, it may be expedient to pull the spikes from the ties that are to come out, ahead of the raising jacks and leave them on their old beds. Immediately behind the jacks, the tie plates are then removed and the ties are loosened and dragged from the track. The remaining ties are then spaced and tamped and the new ties are inserted and tamped loosely. If the raise is small, it may be necessary to place a small shim between the new tie and the rail while tamping.

The whole idea of this plan is to provide enough but not too much space for the tie plates to seat themselves under traffic without becoming loose. The spikes are driven into the new ties at the time the plates are placed, and the gaging that may be necessary is done at this time. After traffic has seated the tie plates, the spikes are tapped down. A competent foreman, working independently of the foreman who is doing the surfacing, should supervise the tie spacing, the tie renewals, the placing of the plates and the gaging, and should be held responsible for his part of the operation.

The sequence to be followed for digging in ties and for renewing ties in connection with raising the track, will vary somewhat with the location, the speed and density of traffic, train schedules and the size of the force engaged on the work. Under all conditions, however, the selection of the ties to be removed, the planning for the distribution and placement of the new ties, and the organization of the force, if thought out carefully, will save both money and time. In all considerations, the safety of trains at regular or restricted speeds should be given first place.

51 Pumping Plants Earn 72% Return

(Continued from page 756)

that are discovered by the section forces are reported immediately to the signal maintainer, who arranges for the necessary repairs.

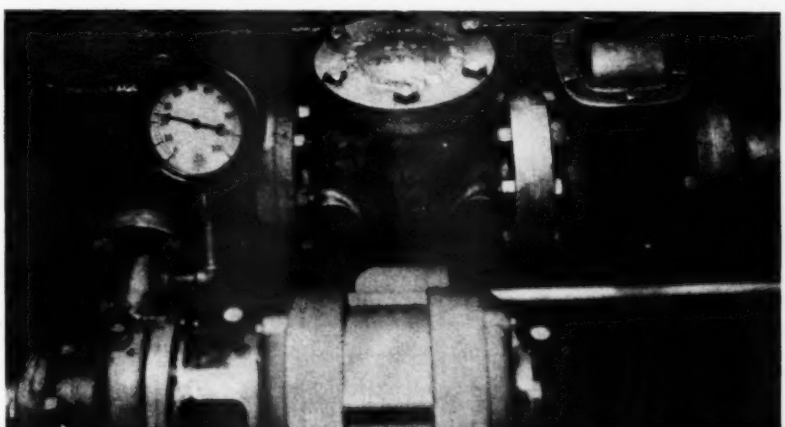
On territories that have large or important automatic pumping installations the signal forces and the pump repairmen carry small supplies of certain spare parts in order to facilitate the making of any necessary repairs. Where repair parts for which there is an urgent need are not available locally, the field forces contact the engineer of water supply by telephone, who obtains an emergency purchasing order from the purchasing agent.

Standby Units Inspected

When single installations are made and it is considered advisable to keep the old steam plants as standby equipment, it is necessary that these units be kept in such condition that they can be depended on to function properly in emergencies. To this end the pump repairmen are required to make quarterly inspections of the steam plants on their respective territories in January, April, July and October, at which times they are required to give the equipment an actual service test by operating it for a short period. The results of these inspections are noted on a regular form which contains spaces for reporting the location, the date of the test, a description of the test and the condition of the equipment, and the name of the employee making the inspection.

Retirements of Water Stations

The retirement of water stations on the Southern is made as opportunities for such abandonments become apparent as a result of changes in operating conditions. When it becomes evident that a particular water station offers possibilities of abandonment, the first step is to determine if the adjacent plants are capable of handling the added load. If this proves to be the case the plant is taken out of service temporarily and the situation is kept under observation for a time. If no complications arise and if, in general, it appears that the station can be dispensed with altogether, the abandonment is made permanent.



Showing the Pump, Motor, Check and Gate Valves, and the Pressure Gage of the Automatic Pumping Installation at Margerum, Ala.

Fastening Blast Plates

What is the most satisfactory method of fastening blast plates to open-deck steel structures? To steel structures with concrete floors? To masonry structures?

Scheme is Simple

By John L. Vogel
Bridge Engineer, Delaware, Lackawanna & Western, Hoboken, N.J.

Two basic principles should govern the design of blast plates and the means for fastening them to the structure—it should not be complicated and it should be easy to renew either the plates or the fastenings if this becomes necessary. The method we employ for attaching blast plates to steel structures fulfills both of these requirements since it is simple, reduces the probability of failure to the minimum, and the fastenings can be renewed easily.

In making the connection to the steel members of open-deck floors, which are generally I-shaped, small vertical plates with two holes are welded on the back side of the blast plates in such position that they will clear the lower flanges of the I-shaped member. These plates, which are only a few inches in length, are intended for connecting a seat angle that rests on the upper surface of the lower flange of the steel member, this connection being made with bolts which, as an added precaution, are protected against the corrosive action of the locomotive gases by means of a protective coating.

If the steel structure has a concrete floor, exactly the same details can be employed. In new work, the plates can be installed before the concrete is placed, the bolts being placed in threaded pipes or special bolt holders to facilitate future renewals. If the blast plates are to be installed on an existing structure, it will be necessary to cut out sufficient concrete to permit the placing of the seat angles. After the plates are in place and the bolts are tightened, the remaining space where the concrete was removed can be filled with concrete or with a heavy mastic to seal it against the entrance of gases.

For masonry structures, the installation can be made by providing inserts, cinch anchors or any other of the many devices available, which will retain the bolts that pass through the blast plates to hold them in place. The heads of these bolts should be thoroughly protected against both the blast and the corrosive action of the stack gases. In new work the holder or insert for the bolts can be set before the concrete is deposited. In old work it will be necessary to drill for the bolt fastenings in the same way as for cinch bolts elsewhere.

Facilitate Inspection

By W. R. Wilson
Assistant Engineer, Atchison, Topeka & Santa Fe, Chicago

Blast plates are applied to prevent the abrasive action and heat of the smoke from locomotive stacks from attacking or eroding the structure which they protect. It is not practical to provide blast plates that will protect the structures from the locomotive gases other than during the blast itself, for which reason it is important that the blast plates be so constructed and attached that there will be no pockets to catch and hold the smoke and allow moisture to combine with it to accelerate corrosive action. Smoke protection for the steel over areas outside that of the blast, should be provided by paint or by a coating of rust preventive. This protection for the concrete can be given by using a dense

Send your answers to any of the questions to the What's the Answer Editor. He will welcome also any questions you wish to have discussed.

To Be Answered in February

1. *What effect do anti-creepers have on the life of rail? In what ways do they produce this effect?*

2. *Should interior painting be done during the winter? What are the advantages and disadvantages?*

3. *What should be the minimum depth of ballast on high-speed, heavy traffic lines? Why? Does the kind of ballast make any difference?*

4. *What is the maximum thickness of shims that should be permitted when surfacing timber trestles? Why? What is the alternative for a greater raise?*

5. *Is there any merit in the application of oil to the faces of switch points to reduce wear? If so, how should it be applied? If not, why? What alternate methods are practicable?*

6. *Where the maps of water facilities are found to be incorrect or incomplete, to what extent are expenditures justified for tracing out underground pipe lines and connections to correct or complete the records?*

7. *What special precautions should be observed in the operation of motor cars during the winter that are not necessary in warm weather?*

8. *When inspecting scales, what details should be given attention? Who should make the inspection? What form of report should he make?*

concrete or by means of a satisfactory surface treatment.

Blast plates should be so designed that the steel or concrete surfaces which they are intended to protect can be inspected readily and so that the steel surfaces can be cleaned and painted easily. It is not necessary to place the blast plates over the entire structure. A plate 5 ft. wide, centered over the track, if on tangent, or shifted from the center enough to allow for the effect of superelevation on curves, will provide blast protection.

On girder or truss spans, the plates may be of sufficient length to extend beyond the limits of the spans, stiffened with angles to make them more rigid, if this is necessary. These plates can be attached to the horizontal members of the trusses or girders, or even to the floor members, by means of bolts through these members, or the bolts can be placed through the plates and along side the girders, and washers of sufficient diameter to rest on top of the flange angles or truss members can be used to support the plates. Washers of smaller diameter should be used as fillers for the thickness of the flange or truss member. A more positive method of support is to use a plate resting on the supporting member, with holes for two bolts, and narrower plates for fillers. These attachments should be placed opposite each other on both sides of the supporting member.

A similar method of attachment is practical for use under beam spans. Galvanized bolts and nuts can be used to prolong the life of these fastenings. The nuts should be on the bottom, so that it can be determined readily by inspection whether they have become or are starting to become loose.

Inserts for the bolts can be placed during the construction of concrete structures. On existing masonry structures cinch anchors may be used. Whatever type of fastening is employed, or whatever the type of structure, the basic requirements are dependability of the fastenings, facility for inspection, and ease of removal and of replacement.

Increasing the Life of Rail

What steps can section forces take to increase the service life of rail?

They Are Routine Duties

By W. Woolsey
Section Foreman, Illinois Central, Chicago

Substantially all of the items of care and attention that will extend the life of rail come within the scope of the routine duties of the section forces and are, therefore, their primary responsibility. Loose joint bolts constitute one of the chief causes of rail wear, because they permit undue wear on the fishing surfaces, and increase the tendency toward rail-end batter. They allow damage to the joint ties and create low joints, which in turn may create churning, all of which aggravate the bad condition and form a vicious circle.

Wide or irregular gage will cause irregular wear from the flanges and may result in line kinks, while tight gage almost invariably results in excessive flange wear on the rail. Closely related to incorrect gage, since it may result from or will cause this condition, poor line may also cause line kinks and irregular wear on the rail. Likewise decayed or defective ties may result in surface kinks, particularly if there are several bad ties in succession. Too much expansion is almost certain to accentuate batter and may cause chipping, while insufficient expansion will cause metal to overlap adjacent rail and result in chipping.

Obviously, with the reduced forces that characterize today's maintenance, it is not possible for the section forces to do all of the work that should be done to insure against rail damage and thus conserve the service life of the rail. On the other hand, by keeping bolts tight, keeping the track lined, to gage and in surface, and the expansion correct, all of which are a part of their routine work, these forces can greatly extend the life of the rail.

Depends on Attention

By N. P. De Nardo
Section Foreman, Alton, Odell, Ill.

Lengthening the life of rail is only a small part of the benefit obtained by giving it the care and attention it should have, for the extra cost of maintaining damaged rail will soon offset the value of the added life that comes through good maintenance. If the rail has been laid properly, its life will depend on the quality of its maintenance. Loose bolts must be tightened, cracked or broken joint bars and broken bolts must be replaced. Ties, especially those at the joints must be kept tamped tight to the rail; the cribs must be filled with clean ballast; and a sufficient ballast shoulder must be maintained. Good drainage through the ballast and in the roadbed is of fundamental importance.

Rail batter can be minimized by keeping the bolts tight, but not tight enough to freeze the joints and thus prevent uniform distribution of the expansion and contraction. Solid tamping of the joint ties and sound timber under the joints will also aid in retarding batter. The percentage of rail damaged by end flow of the metal on the running surface and subsequent chipping is high if the rail is allowed to get tight, and this can be prevented in large measure by tight bolts and adequate anchorage.

Solid tamping of the ties will not be fully effective unless they are spaced properly, because the rail will have an uneven bearing. Trains should not be allowed to pass while one or more ties are out, because this may cause surface bending. The rail should be sprayed with a good asphalt-base oil at least once a year, but if this is not done, the section forces can apply oil to the joint bars and fastenings with advantage to the life of the rail.

Can Do Many Things

By Garland Weddington
Section Foreman, Chesapeake & Ohio, South Fayette, W. Va.

The section forces can do many things to increase the service life of rail. If the rail had the correct expansion openings, was spiked to true gage and was anchored when it was laid, and the ties were adzed properly, some of the more important items of track maintenance which will influence this result will be mentioned.

Adequate drainage is basic, since lack of drainage results in sloppy track and low joints, causing surface-bent rail. The side ditches and cross drains should be kept open to provide free passage of surface water. The ballast should be cleaned or renewed, or both, periodically to prevent stack screenings and other foreign matter from blocking drainage through the ballast section.

Sound ties under the joints are also a fundamental requirement, since they must bear more abuse from both traf-

fic and tamping than intermediate ties. Unsound timber may be as bad as a churning joint tie and will probably result in churning.

Bolts should be kept tight at all times to minimize wear on the fishing surfaces, to prevent surface bending and to avoid rail chipping. If the bolts are kept tight, the life of both the rail and the joint bars will be prolonged.

Line and cross level together constitute one of the most important phases of track maintenance. If the line is allowed to become irregular on curves, it is sure to result in flange-cut rail on the high side of the curve, where the curvature suddenly becomes sharper, and irregular elevation will cause the low rail to mash at points where the elevation increases rapidly. These items have become more important recently owing to the marked increase in train speeds, and the insistent demand for more comfortable riding at these speeds. To accomplish the desired results, constant smoothing and lining are necessary, and when these have been carried to the point where the track becomes dead, it must be given a general surface, both to preserve its riding qualities and to protect the rail from abuse.

While heavy rail and large tie plates have done much to reduce the amount of gaging, they have in no way reduced the importance of correct gage, and periodic gaging is still necessary. Tight gage will cause flange wear on the side of the rail head and wide gage will cause the metal to flow from the running surface and result in mashed heads on the low side of curves. Irregular gage on tangents always causes poor-riding track and irregular flange wear on the rail.

Where there is sharp curvature, as in mountainous or hilly country, and there are no mechanical rail-and-flange lubricators, the rail should be greased by hand often to prevent the wheel flanges from cutting the high rail on the curves. Where lubricators are installed, the foreman should see to it that they are in working order at all times and that they are kept filled with the lubricating compound.

How to Overcome Dusting

Where a concrete floor exhibits a tendency to dust, what means can be employed to overcome the trouble?

Remedies Vary

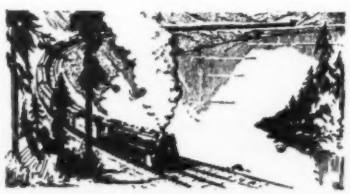
By M. Hirschthal
Concrete Engineer, Delaware, Lackawanna & Western, Hoboken, N.J.

Dusting in concrete floors is a form of deterioration of the concrete that may be caused by any of the elements that enter into the causes of concrete deterioration in general. In other words, it may result from the use of poor materials, that is, poor cement, poor sand or unsuitable water. The trouble may be in proportioning, particularly to a water-cement ratio that is too high, or to methods of placement that result in water gain and accompanying segregation of the materials in the mix. In addition, the surface may have been troweled too soon, before initial set, or the troweling may have been overdone, thus bringing too much moisture to the surface, with the same effect as a high water-cement ratio.

Another cause is the practice sometimes indulged in of sprinkling dry cement on the surface to absorb excess water. This results in unhydrated cement crystals that are subject to pulverization. As stated in the beginning, dusting is the first sign of disintegration, indicating loose particles of sand or cement, and will eventually result in the failure of the floor.

In general, the remedy will vary with the requirements of economy and space. If the expense is justified and room is available, a minimum topping of ½ in. of good concrete is the best remedy. Whatever remedy is adopted, however, the first essential is to remove all loose particles and have the surface perfectly clean before any coating is applied. If the new topping is decided on, the surface must be roughened and picked to provide the required bond for the new top. The new topping can then be applied to the roughened and cleaned surface by any approved method, using materials and proportions suitable for the wear to which the floor is subjected. I prefer either the blotting or the vacuum method.

If this expense is not warranted, probably the best remedy will be one of the cement hardeners now on the market, composed chiefly of sodium or magnesium fluosilicates. They are called liquid hardeners and are sold as proprietary materials by several reputable companies. In addition, there are several excellent cement floor paints on the market, which, when applied to absolutely clean surfaces, will prevent dusting.



Results somewhat less satisfactory have been obtained by using combinations of oils, such as boiled linseed oil with China wood oil. All of these oils and paints have a limited life, however, and their application must be repeated in three to five years, or oftener if the floor is subjected to hard usage. With paint or oil coatings it is important that renewal is not deferred to the point where the wear reaches the concrete surface.

Can Be Prevented

By A. J. Boase
Manager Structural Bureau, Portland Cement Association, Chicago

Dusting can be prevented by proper construction methods. A well-laid floor that has been cured adequately and then protected during other building operations will be free from any appreciable amount of dusting under normal conditions. Dusting often occurs when the floor is first placed in service, because it was not protected during building operations and loose dirt has accumulated on the surface. Such floors may be scrubbed by machine with pads of fine steel wool instead of the usual brushes. This should be followed by brush scrubbing with a rich neutral soap solution and the floors then mopped clean. In other cases, a few moppings with a rich soap solution at intervals of several days will correct the difficulty.

Some floors may have a tendency to continue dusting because they were not constructed properly. Flagrant violations of good construction practice cannot be rectified after the work is done, but the surface application of a floor hardener solution will often stop quite serious dusting if the floor otherwise appears to be sound. There are a large number of proprietary floor hardeners on the market. Chemicals supplied for mixing into solutions on the job are also available from wholesale chemical houses. The fluosilicates, sodium silicate, aluminum sulphate and zinc sulphate are used for this purpose.

A mixture of 20 per cent of zinc fluosilicate and 80 per cent of magnesium fluosilicate appears to be effective. A solution containing ½ lb. of the fluosilicates to the gallon of water is used for the first application, and 2

lb. to the gallon for subsequent applications. The solution may be mopped on or applied with a sprinkling can and spread evenly with mops. Two or more applications should be given, allowing three or four hours or overnight between applications for drying. After the last application has dried, the floor should be mopped with water to remove any crystals that may have formed.

The sodium silicate should be thinned with about three gallons of water to the gallon of the silicate. Two or three coats should be applied, allowing each coat to dry thoroughly before the next one is put on. Scrubbing each coat with a fibre brush and water helps the penetration of the next coat.

The aluminum sulphate solution must be made in a wooden barrel or stoneware vessel by adding 2½ lb. of powdered aluminum sulphate and one teaspoon of commercial sulphuric acid to the gallon of water. The sulphate does not dissolve readily and requires occasional stirring for a few days for complete solution. For the first treatment this solution should be diluted with twice its volume of water, but for subsequent applications it should be used full strength, and 24 hours should be allowed between applications.

The zinc sulphate solution is made by dissolving 1½ lb. of the zinc sulphate in a gallon of water to which one teaspoon of commercial sulphuric acid has been added. This mixture is applied in two coats about four hours apart. The surface should be scrubbed with hot water and mopped dry immediately before the second application.

Drying oils such as linseed, tung or soy-bean oil, well thinned with turpentine or other thinner, can also be applied to concrete floors to overcome dusting. Boiled linseed oil is preferred to the raw oil, since it dries more rapidly. The oil may be applied with mops and will penetrate somewhat better if heated. It is not necessary to build up a surface coating, and any excess oil should be removed with a squeegee before the oil becomes tacky. This treatment may be repeated as required.

Supplies for Motor Cars

Should foremen be allowed to keep on hand a stock of supplies and extra parts for motor cars? If so, what stocks should they carry? If not, why?

An Unwarranted Expense

By C. R. Edwards
Supervisor of Scales and Work Equipment, Wabash, Decatur, Ill.

Before this question can be answered either affirmatively or negatively, it must be determined whether it is of greater importance that a motor car be maintained in service continuously at the expense of economical maintenance or whether continuous service shall be sacrificed to insure economy. Without minimizing the ability of the average user of a motor car to diagnose correctly any fault that may develop, we should not be unmindful of the fact that a particular symptom may result from several causes, and that the correct diagnosis can be made only by a person having considerable experience in the repair and adjustment of motor cars, and particularly of the engine.

Too often an attempt is made to discover the source of a fault in operation by a process of elimination, such as the application of a new carburetor or a new coil, when the defect may have been an exhausted battery, with nothing at all the matter with the carburetor or the coil. When this is done and the real cause of the trouble is discovered later, it is a safe bet that the old carburetor or coil will not be replaced on the car and used again.

The practice of providing spare parts or of permitting the operators of motor cars to make major repairs, other than in exceptional cases, will most likely result in unwarranted expense. Instances have been noted where an incorrect flywheel was ordered and applied, which resulted in an engine that was badly out of balance, with corresponding damage to the car. Many instances have occurred in which the spokes in the flywheel have been broken when attempting to install crankshaft bearings without the proper tools.

Likewise, too many cases have occurred in which crankshafts have been discarded because the inner race turned on the shaft, or the race may have been installed on the old crankshaft without correcting the worn condition, which made the repairs of doubtful value. One instance is known in which a complete engine was assembled from parts ordered one at a time over a period of several years, at a cost that would have purchased an engine of the latest model.

I do not approve of foremen carrying a stock of repair parts, with the exception of minor items, such as spark plugs, vibrator and timer points, timer springs, and possibly an extra battery, provided the latter is ordered only a short time before it is expected that the old battery will be exhausted. A few spare motor cars, located at strategic points, as at the roadmasters' headquarters, will require a much smaller investment than the stocking in section houses of such parts as would be required to insure the continuous operation of the motor cars. Furthermore, such a stock is certain to become obsolete as the cars in service are retired and later designs are purchased to replace them.

Needs a Few Items

By Jack Ausland
Wichita Falls, Tex.

Foremen should be provided with a few spare parts, including an extra set of batteries, an extra spark plug, a timer spring or button, a coil point and some insulated wire. None of these items is expensive, nor do they take up much room on the motor car, where they should always be kept, except perhaps the battery which will better be left at the tool house except when the battery in service is getting low. If any of these parts fail, the result is the same as if the engine itself became damaged. When any of the items mentioned go bad, the gang is generally far from any probable source of supply, and it does not seem reasonable to expect a gang to risk having to push a car to the section house, perhaps several miles away, for lack of parts that total less than $2 in value and do not deteriorate easily.

Too Many Parts

By L. G. Byrd
Supervisor of Bridges and Buildings, Missouri Pacific, Poplar Bluff, Mo.

Where motor-car repairmen are employed on the divisions, and an organized system of motor-car repairs is in effect, I can see no advantage in allowing foremen to keep stocks of motor-car parts on hand. We have motor cars in operation with more than 600 parts, and on some of them there are as many as 130 parts that are so important that if any one of them failed it would put the car out of commission or make it dangerous to operate it. The problem then is to determine what these parts should be if we were to allow a stock of parts to be in the foreman's possession. He might be carrying, say, 50 parts; yet if any

one of the remaining 80 parts were to fail, he would be in the same position as if he had no stock; that is, he would be unable to make the needed repairs and would be compelled to wait until the replacement could be sent to him or the repairman arrived.

Almost all motor-car parts are expensive and it would require a large investment, which would be tied up permanently, if each foreman were allowed a supply of extra parts. Furthermore, there are not a few foremen who are operating motor cars regularly who have not had sufficient mechanical experience to enable them to apply replacement parts. In fact, few foremen are able to ascertain with any degree of certainty just what is the matter with a car when it is out of commission, unless the trouble is as obvious as a bent axle or a missing bolt.

For these reasons, it is not our practice to allow foremen to carry motor-car supplies. We have a well-organized equipment-repair department, and the repairmen cover the division frequently, inspecting all motor cars and making such repairs as can be made in the field. When heavy repairs are needed, the motor cars are shipped to the shop for general overhauling, and relief cars are provided for use until the regular car is returned, or replaced if it is found that it should be retired.

Is Not Necessary

By C. H. Ordas

Supervisor of Motor Cars, Chicago, Milwaukee, St. Paul & Pacific, Chicago

We do not find it necessary on the Milwaukee to permit foremen to carry spare parts for motor cars, other than a spark plug or two. In the first place it is difficult, if not impossible, to foretell just what part or parts may fail by reason of breakage or other form of failure, in such a way as to put the car or engine out of service.

Parts that wear do so gradually and failure from wear can be foretold far enough in advance to allow the foreman to obtain a replacement part in ample time to forestall actual failure. In the event that a complete failure of any part occurs unexpectedly, foremen are permitted to telegraph their superior officer, and he in turn wires the division storekeeper, who ships the part in question by baggage to the foreman with very little delay.

We carry a spare car on every road-master's division, which he can send to any foreman by the first local freight, or run it to him if the distance is not too great, whenever his car fails completely. When a car fails so that the foreman has no means of transportation, his section is looked after by the adjacent foremen whose cars are in operating condition until the bad-order car is again ready for service or has been replaced. Under this arrangement, with modern cars and engines and with an organized system of maintenance, it is a rare exception when a car goes out of service.

Spotting of Varnished Surfaces

What causes varnished surfaces to spot? What can be done to prevent this?

Sometimes Poor Material

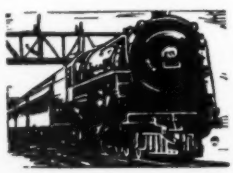
By L. G. Byrd

Supervisor of Bridges and Buildings, Missouri Pacific, Poplar Bluff, Mo.

Probably the most common cause of the spotting of varnished surfaces is failure to clean the surface thoroughly before the varnish is applied. Application over a surface that is not thoroughly dry will also result in spotting. Poor material is also responsible for many cases of spotting, for inferior varnish will almost invariably spot when any liquid comes into contact with it. If water is allowed to stand on a varnished surface for a short while, it will cause spotting if the surface to which the varnish was applied had not been prepared properly, if the varnish was of inferior quality or if too few coats were applied.

To avoid spotting, the surface must be cleaned thoroughly and must be dry. If the wood is open grained, it is desirable that it receive a coat of paste filler which should be rubbed strongly into the surface of the wood with a stiff brush. It should be allowed to set, which usually requires from 30 to 40 minutes, after which it should be rubbed off with a harsh cloth or a hand full of excelsior. The rubbing should be hard and across the grain, but the brush used in making the application and the original rubbing should not be stiff enough to tear the wood fibres and thus roughen or fray the surface.

If it is desired to stain the wood, an oil stain may be mixed with the filler. On the other hand, if the wood is close grained it will not require a filler, and the oil stain should be thinned to the shade desired with turpentine or benzine and applied as a wash. If benzine is used as a thinner, great care should be exercised to insure that it will not become ignited. Certain concentrations of the gas resulting from evaporation of the benzine are highly explosive, for which reason it should never be used around open lights or fires. If puttying is necessary, this should be done as soon as the stain or the paste has been applied.



The first coat of varnish should not be applied until two days later, and should be allowed to dry for five days. It should then be rubbed with curled hair or fine sandpaper to remove the gloss so that the next coat will adhere well. Then one, two or three more coats, as desired, may be added at intervals of five days, with each coat, except the final one, rubbed as before. The last coat may be rubbed, if desired, or left with its natural gloss. If a good grade of varnish is used, there should be no spotting, provided the foregoing procedure is carried out.

Surface Not Uniform

By General Inspector of Buildings

No wood surface is uniform with respect to porosity or absorbent power and if a stain is applied to the bare wood, some areas will absorb more of it than others, with the result that it will be practically impossible to obtain a uniform finish. This may not be apparent immediately, however, but if varnish is applied, the less porous areas will ultimately be darker and the varnish will have a spotty appearance.

If the wood has an open grain, a paste filler should be applied and rubbed in thoroughly across the grain. It should then be left alone for 30 to 45 minutes and again rubbed thoroughly, this time with a clean coarse cloth, after which the surface should be wiped clean. The filler should be allowed to dry thoroughly, say for 48 hr., before the stain is applied. If one has reliable, experienced painters it will be possible to mix colors in oil with the paste filler to produce the desired stain and thus do the filling and staining in a single operation.

Some painters use a priming coat composed of equal parts of raw lin-

seed oil and turpentine to provide a foundation for the stain on new unpainted surfaces, especially on the soft woods, while others apply a clear varnish. It should not be overlooked, however, that linseed oil tends to darken the wood. Varnish stains should never be applied directly to bare wood surfaces, because they will give a uniform color only if the surface has uniform absorbent power.

Some stains exhibit a tendency to bleed, and to overcome this it is advisable to apply a thin coat of shellac after the stain has dried thoroughly. In fact, this is the safest course to take with all stains, although it is seldom absolutely necessary with oil stains. One should be sure, however, that the shellac does not contain rosin. It will not be necessary to use white shellac for, since the wood is stained, orange shellac will be satisfactory.

One of the important things to remember in this connection is that every coat—filler, stain, shellac and varnish—should be allowed to dry thoroughly before the following coat is applied. It is also a good idea to go over the shellac and each succeeding coat of varnish lightly with a fine-grained sandpaper to roughen the surface and thus provide a tooth for the next coat.

Line and Surface at Turnouts

What measures should be employed to insure the maintenance of line and surface at turnouts?

Study Local Conditions

By J. L. Monk
Section Foreman, Southern Pacific, Tombstone, Ariz.

To determine the best method of maintaining line and surface at turnouts, one should study the conditions surrounding the use of the turnout under consideration, for, while the basic requirements will be the same for all turnouts, the items to be given attention may vary somewhat as they are influenced by this use. One of the most important factors with respect to line is rail creepage, and this can be overcome only by the use of an adequate number of anti-creepers for a sufficient distance from the turnout to insure that the rail will be held immobile so far as longitudinal movement is concerned. On busy main lines this may be as much as a mile. To prevent rail creepage from affecting the frog, it is usually best to adjust the expansion allowance before the anti-creepers are applied. If rail movement is controlled, the remainder of the job of keeping the turnout in line and surface does not differ widely between turnouts, although drainage, ballast, tie plates, gage rods, etc., will be important in varying degrees according to the local conditions.

Line Track First

By Roadmaster

To insure the maintenance of good line and surface at turnouts, both the main running rails and the turnout rails should be in correct line before they are spiked, for it is an impossible task to line a turnout if this is not done. In many cases difficulties in maintaining good line can be traced to errors of installation.

Rail in main-line turnouts should be new, and in secondary lines laid with released rail, the best of the No. 1 relayer rails should be selected for the turnouts. Rail with battered or chipped ends or with appreciable wear on the side or running surface is not satisfactory for this service. Joint bars should be new or in first class condition, and the bolts should be kept tight at all times.

Gage must be maintained at all times on both the main track and the turnout lead, and the track should be fully spiked and fully tie plated. Guard rails and frogs should be kept secure and where necessary gage rods should be applied, but this latter item will depend in large part on the character and volume of the traffic and the extent to which turnout movements occur. Ties must be kept in first class condition and the turnout should be protected against the effects of rail creepage by an adequate installation of anti-creepers on both sides of and through the turnout.

Ballast is an important factor in the maintenance of line and surface through turnouts. On main lines the minimum depth should be 18 in. of clean hard, crushed stone, washed gravel, crushed slag or other superior material. The same quality of ballast should extend from a rail length ahead of the points to the clearance point behind the frog. Drainage is of prime importance, with respect to both the ballast and the subgrade, but the best means to provide drainage will generally depend in large measure on local conditions.

When surfacing, the ties should be tamped with picks or tie tampers for about 10 to 12 in. each side of the rail, and the remainder of the distance with shovels. The reason for this is that if solid tamping is done over the full length of the switch ties, the track is likely to become center bound. After the turnout has been surfaced and lined, the cribs should be well filled, except those containing the bridle rods, and a heavy ballast shoulder should be maintained.

Rate of Flow for Treated Water

What is the maximum rate at which treated water should rise in a continuous-process tank to insure the removal of all precipitated solids? Is a lower rate than the maximum desirable? Why?

Requires 5 ft. Per Hour

By Water Service Inspector

I remember that when our first continuous-process treating facilities were installed, they were designed for a rate of upflow of 10 ft. an hour at the maximum estimated 24-hr. draft on the service tank, and strict instructions were issued that this rate must not be exceeded. Later the demand for water at many of our stations increased, and we relaxed somewhat on this requirement, with the result that we got a lot of milky water over into the service tank and we had trouble with foaming. To correct the trouble, we put in sand filters, but this did not effect a complete cure, for some of the solids remained in solution, passed the filter and precipitated after they were in the storage tank.

In some cases we have been compelled to enlarge our treating facilities to overcome the difficulty. In others we have bettered conditions considerably by the use of sodium aluminate, which tends to accelerate the settlement of the precipitates. In fact, we now use this chemical at all of our lime-soda ash plants. All of our later plants have been designed for an upflow of 5 ft. an hour, which I think

is about right when one considers variations in demand and that precipitation is slowed down noticeably during cold weather, and that it is seldom practicable to vary the rate of pumping with the variation in temperature.

Allows 6 ft. an Hour

By Water Service Inspector

I have checked the rate of precipitation in both continuous and intermittent plants on numerous occasions and have found this rate, where the straight lime-soda ash treatment is given, to be about 8 ft. an hour. Where sodium aluminate is added, the rate may rise to 10 to 11 ft. an hour. These observations were made during warm weather, and it should not be overlooked that both the formation of the precipitate and the rate of settlement are slower during cold weather.

It is not always safe to assume that the maximum permissible rate is the normal rate, for there may be peak drafts on a water station that will make it necessary to pump water at a much higher rate than normal. This will leave no margin of safety, for which reason I prefer to install sufficient capacity to give a margin to work on. Our plants are designed for a normal flow of 6 ft. an hour, so that we can increase our normal output 33⅓ per cent, even in cold weather, without danger of getting sludge in the storage system, thus causing foaming.

Thick Shims and Gage Rods

When it becomes necessary to use thick shims, should gage rods be used to reduce the amount of bracing? If not, why? If so, what should be the relation between the thickness of the shims and the number of gage rods?

Do Not Reduce Braces

By F. J. Liston
Roadmaster, Canadian Pacific, Montreal, Que.

Rail braces, whether of wood or other materials, are not required where shimming is done on either tangents or curves that are equipped with shoulder tie plates of a design that can be used on the top of the shims. Irrespective of their thickness, when properly applied, shims lose their individuality and become a part of the tie. To insure that this will be so, care must be exercised to see that the surfaces of both the tie and the shim are entirely free from ice or snow, for the track is much more likely to spread if ice or snow is allowed to get between the bearing surfaces between the tie and the shim.

Special shimming spikes, measuring 6½, 7½ or 8½ in. should be used wherever shims are employed, for the depth of the spike in the tie diminishes as the thickness of the shim increases, and it follows that the holding power of the spike is decreased accordingly. If the longer spikes are not used, the side thrust of trains might tend to bend the standard spikes and cause a widening of the gage.

When shimming becomes necessary, the shims should be applied in such a way as to provide easy and safe runoff gradients from the high point. Where one side of the track has lifted more than the other, and this is not uncommon, the cross level must be restored. When installing shims on curves, care must be taken to maintain the correct curve elevation. Two shims of the same length should not be used under one rail on the same tie. One 12-in. shim may be used on top of one 24 in. long, or on top of a 7-ft. shim. Again, one 24-in. shim may be used over a 7-ft. shim, or a 12-in. shim may be placed on top of a 24-in. shim which has been placed over a 7-ft. shim. Where possible, a single shim of the proper thickness should be used. Where two shims are required, the lower one should have the greater thickness; and where three shims are necessary the bottom one should be the thickest, with the intermediate one next in depth.

In all cases where shims 12 in. or 24 in. long are employed, or a 12-in. shim is installed on top of a 24-in. shim, all spikes driven through the shims should be long enough to provide a minimum penetration of 4 in. in the tie. Where a 7-ft. shim is employed, it should be independently but firmly spiked to the tie with 7½ in. shimming spikes. If a 12-in. or a 24-in. shim, or a 12-in. and a 24-in. shim in combination, is used on top of a 7-ft. shim, all spikes should be long enough to extend through the 7-ft. shim and at least 1 in. into the tie.

Where shimming is carried out along the foregoing lines, although the track will be disturbed by reason of the insertion of the shims, it will retain its stability in a manner comparable to that of its original state, and will require no additional strengthening by means of braces or gage rods. Where shimming is done on curves that have not yet been tie plated, or is equipped with shoulder plates of a design that must not be used on top of shims, wood or other approved rail braces must be installed. In this case, bracing is reduced to the minimum consistent with safety, and gage rods are not used to effect a further reduction in the number of braces.

Difference of Opinion

By District Engineer

This is a subject upon which I have found considerable difference of opinion among experienced maintenance officers with whom I have discussed shimming practices. Some hold that gage rods are a distinct advantage, while others prefer not to use them, and still others use them to some extent. In my own experience I have used them to advantage on numerous occasions, especially on curves.

On this road we use hardwood shims, 7 in. by 10 in., up to ¾ in. thick, and place them between the tie plate and the tie, the thickness being increased by increments of ⅛ in. Shims 1 in. or more in thickness are 24 in. long besides which we also use shims 7 ft. long where high shimming becomes necessary. All shims are bored for spikes, and up to ¾ in. we rely on the rail spikes to hold the shims in place and the track to gage, but use oak braces chamfered to fit under the rail head and beveled to fit the tie, with two holes for spiking the brace in place. The longer shims are also bored for boat spikes, which are employed as independent fastenings, and longer shimming spikes, up to 8½ in., are used for fastening the rail.

We do not use rail braces with these longer shims as we do not consider them necessary, except in cases where the track tends to get out of level by reason of continued heaving after the shims have been applied. It is in cases of this kind that I have employed gage rods to advantage, since they reduce the tendency of the track to spread and thus effect a considerable reduction in the forces acting on the spikes. I have never thought it desirable, however, to reduce the number of braces after the gage rods were applied. Where heaving occurs on curves, the problem of keeping smooth-riding, safe track is more difficult and here gage rods are of still greater advantage, although I would not reduce the number of braces when shimming on curves because the gage rods have been employed.

New and Improved Products

New Colormix-Kuro-Krome Concrete Floors

THE Master Builders Company, Cleveland, Ohio, has improved its Colormix process of making finished-surface, colored concrete floors by the improvement of its Colormix compound, which is now produced as a fine, dry powder, and by the use of the KuroKrome curing, protecting and finishing process.

In the preparation of colored concrete floors by this process, Colormix of the color desired is mixed with the concrete in the proportions specified. As soon as the fresh colored concrete has hardened, the KuroKrome finish coating in liquid form is applied and covered with ordinary building paper until it has set.

Colormix is a powder of intense dyeing power, which is said to produce deep stable shades of color in the concrete, with a minimum quantity of inert oxides. This compound also contains Master Builders Omicron, a water-reducing agent, which is said to eliminate 30 per cent of the excess water used in ordinary floor mixes and to assure a much higher strength concrete, minimum porosity and freedom from shrinkage cracking.

The KuroKrome finishing process produces a wear-resistant surface of the same color. It dries rapidly providing an air-tight seal which holds moisture in the concrete and allows better curing. It is said that the KuroKrome coating eliminates any chance for salts or efflorescence to mar the color, dyes out any imperfections or non-uniformity of color, prevents absorption of stains by the new floor and provides a smooth, non-slip surface.

Colormix and KuroKrome are available in eleven shades and are used in the proportion of 5 to 10 lb. of Colormix per sack of cement and one gallon of KuroKrome for 500 sq. ft. of surface.

New Armco Pipe Arch

THE Armco Drainage Products Association, Middletown, Ohio, has produced a new Armco pipe arch designed primarily for locations of low clearance or headroom, which is said to possess unusual hydraulic efficiency in addition to retaining the advantages of standard corrugated metal pipe, such as ease of handling, speed of installation and strength to resist impact and undermining.

Placing an Armco Pipe Arch in a Low Fill

The pipe arch is constructed of two pieces, an upper circular arc and a lower flat semi-elliptic arch of corrugated, galvanized ingot iron, factory riveted together into a single piece. The sections of Armco pipe arch may be fastened together with a standard coupling similar to those used for coupling standard corrugated pipe.

It is said that extensive dead-load and live-load tests of the Armco pipe arch show that it has strength closely comparable to that of standard corrugated pipe of equivalent span or diameter. This new product is available in spans ranging from 18 in. to 72 in., with a corresponding height of from 11 in. to 44 in., the height being a little less than two-thirds of the span. It is also available in plain-galvanized Armco ingot iron or with bituminous paved-invert in the bottom.

New Books

Wood-Preservers' Proceedings

PROCEEDINGS of the American Wood-Preservers' Association for 1939. 503 pages, 6 in. by 9 in. Illustrated. Bound in cloth. Published by the Association, 1427 Eye Street, N.W., Washington, D.C. Price $6.

This volume contains forty-one papers and committee reports, together with the discussions which followed, which were presented before the thirty-fifth annual convention of the association at Washington, D. C., in January.

Among the reports of special interest to these officers are those on the fireproofing of timber; an international termite exposure test; service records of ties, fence posts and poles; and on specifications for the treatment of ties, timber, lumber, piles, posts and poles. Among the papers of special interest to them are those on The Experience of the Norfolk & Western With Treated Timber, and What the Baltimore & Ohio Has learned From the Treatment of Timber, Other Than Cross and Switch Ties. Others containing much valuable information with respect to preservatives, treatments, and uses of treated timber in related fields discuss the effect of sodium bichromate on the preservative value of zinc-chloride; the corrosion of metal fastenings in zinc-chloride treated wood after ten years; the field for treated timber in the construction of public buildings; the navy's experience with treated wood; and the place of treated timber in highway construction.

The volume also includes a detailed report of the business sessions of the thirty-fifth convention, and in its Statistical section, the thirtieth annual consecutive report, for the year 1938, of the quantities of wood treated and preservatives used in the United States, prepared by R. K. Helphenstine, Jr., of the Forest Service, United States Department of Agriculture, (abstracted in the August issue) and a list of the wood-preserving plants in the United States, Canada and Mexico.

NEWS of the Month

Ashburn Resigns as Head of Inland Waterways

Major General T. Q. Ashburn, chairman and president of the government-owned Inland Waterways Corporation, resigned on November 14, and Chester Thompson of Rock Island, Illinois, a former member of Congress, was appointed to succeed him. In a statement Major General Ashburn said that he was asked for his resignation and "was very glad to give it."

Nearly 16 Million Long Island World's Fair Passengers

During the six months from April 30 to October 30, the Long Island Railroad carried 15,727,906 passengers to and from the New York World's Fair. This total includes 13,972,457 passengers who used the special "World-of-Tomorrow-For-10-Cents" shuttle trains. It is estimated that the Long Island carried one out of every four persons visiting the Fair.

Eastern Roads Request Continuance of 2½-Cent Fare

At a meeting of the Eastern Railroad Presidents' Conference in New York on November 16, it was decided to petition the Interstate Commerce Commission for a further nine-months' continuance of the basic passenger fare of 2.5 cents per mile for coach travel. The basis of the request is to obtain a normal test period between the close of the World's Fair in New York on October 31 and its re-opening next Spring, in which to gage the effects of the fare on revenue and traffic volume. If the extension is not allowed, Eastern coach fares will automatically revert to a basic 2-cents-a-mile rate on January 24, the expiration of the 18-months' trial period allowed for the 2.5-cent rate by the I.C.C., effective July 25, 1938.

Committee Appointed to Recommend Minimum Wage Rate

On November 3 the Wage and Hour division of the U. S. Department of Labor announced the appointment of a committee of 12 members, representing the public, the employes and the employers, headed by Frank P. Graham, President of the University of North Carolina, to investigate conditions in the railroad industry and to recommend to the Administrator the highest minimum wage rate (up to 40 cents an hour) which will not substantially curtail employment. The Labor Department announcement further stated, "Estimates obtained from railway organizations indicate that at present there are approximately 100,000 railway workers receiving less than 40 cents an hour. The great bulk of these are maintenance-of-way workers."

A.A.R. Plans Continued Research Work

The Association of American Railroads has adopted a program continuing for the coming year a wide range of research activities designed to result in further improvements in railroad locomotive, car and track construction, and in methods of operation. The program includes further studies in improvements in steam locomotive construction to increase speed, power, and efficiency without a proportionate increase in weight or in the use of fuel; studies in the use of lighter weight metals and welding for the construction of lighter freight cars; and numerous studies looking toward a further improvement in track construction, including research on welding work, a study of the economics of the use of different sizes of rails, the impact of train wheels on tracks and bridges under varying speeds and loads, improved fastenings for rails and the control of corrosion of bridges and tracks.

Chemical to Prevent Brine Corrosion

A chemical has been developed which will inhibit the corrosive effects of the brine that drips from refrigerator cars on equipment, track and bridges, and which is expected to realize an annual saving of two million dollars, according to the Association of American Railroads. Development of the chemical resulted from a series of laboratory tests conducted by the Association in cooperation with various railroads to develop a chemical which, when added with the salt, would inhibit corrosion by the brine without interfering with refrigeration.

Eastern Roads To Restrict Passes

Regulations were recently adopted by the Eastern Railroads Presidents' Conference and the Presidents' Traffic Conference—Eastern Territory, effective January 1, 1940, to abolish the issuance of complimentary annual passes and "commutation" passes by foreign lines, and to drastically restrict the issuance of foreign line trip passes to officers and employes. The issuance of foreign line trip passes will be based upon the following table, based upon the length of service of officers and employes:

	Trips per Calendar Year
Less than 5 Years' Service	None
5 to 10 Years' Service	1
10 to 15 Years' Service	2
15 to 20 Years' Service	3
20 Years' Service, or more	4

Large Gain in October Revenues

According to the Association of American Railroads, preliminary reports from 90 Class I Railroads, representing 81.8 per cent of the total operating revenues, show that those roads, in October, had estimated operating revenues amounting to $339,895,107, compared with $289,279,715 in the same month of 1938, and $394,561,926 in the same month of 1930. The October gross was 17.5 per cent above that of October, 1938, but 13.9 per cent below October, 1930.

Eight Millionth Zephyr-Mile Recorded

To commemorate the completion of eight million miles by the nine Diesel-electric Zephyrs of the Chicago, Burlington & Quincy since the first one was placed in service on November 11, 1934, the eastbound Denver Zephyr when it passed a point east of Belmont, Illinois, at 8:12 a.m. on November 5, eased through a large circle of paper on which was printed in letters six feet high, "Eight Millionth Zephyr-Mile."

Grand-Circle Fares To Be Continued

The sensationally low grand-circle railroad fares which were in effect during the two World's Fairs last summer, were so popular, according to J. J. Pelley, President of the Association of American Railroads, that they will be continued until October 31, 1940. The grand-circle fares, which were described in the March issue, provided for a coach fare of $90 from any point in the United States to both New York City and San Francisco and return without retracing routes.

Association News

Roadmasters Association

President G. L. Sitton has called a meeting of the Executive Committee at Chicago on Saturday, December 9, to complete the organization of committees for the ensuing year and to transact other business as should come before the association.

Bridge and Building Association

President A. E. Bechtelheimer has sent a questionnaire to members of the association soliciting their preference for assignments to the eight technical committees that are to prepare reports during the year for presentation at the next convention. When these returns are received, the Executive Committee will meet to canvass them and to make specific appointments to these committees.

Metropolitan Maintenance of Way Club

The next meeting of the club will be held at the Governor Clinton hotel, New York City, on December 7, following a luncheon at 12 o'clock. The speaker will be Dr. Herman von Schrenk, consulting timber engineer of St. Louis, whose subject will be Timber Preservation. In scheduling the meeting for this date the club is following its usual practice of holding its December meeting on the same day as the annual evening dinner of the New York Railroad Club.

Maintenance of Way Club of Chicago

Ninety-seven members and guests were in attendance at the meeting in the Auditorium hotel on the evening of November 27, which was addressed by L. L. Adams, engineer maintenance of way, Louisville & Nashville, who discussed The Selection of Motor Cars and Trailers to Meet Today's Changed Conditions. The next meeting of the club will be held on December 18, and will be addressed by J. M. Farrin, assistant engineer, Illinois Central, who will discuss The Lessons Learned About Rail Damage During Locomotive Speed Tests Conducted on the Illinois Central.

Wood Preservers Association

Ballots have been distributed to members containing selections for officers of the association for 1940 as follows: President, R. E. Meyers, sales manager, International Creosoting & Construction Company, Galveston, Tex.; first vice-president, W. R. Goodwin, engineer, wood preservation, Minneapolis, St. Paul & Sault Ste. Marie, Minneapolis, Minn.; second vice-president, W. P. Conyers, Jr., vice-president and treasurer, Taylor-Colquitt Company, Spartanburg, S.C.; treasurer, H. L. Dawson, secretary-treasurer, American Wood-Preservers' Association, Washington, D.C.; and members of the executive committee, R. H. Colley, engineer, Bell Telephone Laboratories, New York, and S. D. Hicks, vice-president, Southern Wood Preserving Company, Pittsburgh, Pa.

The details of the program for the convention, which will be held at the Coronado Hotel, St. Louis, on January 23-25, 1940, are now practically completed and announcements will be distributed to the members early in December.

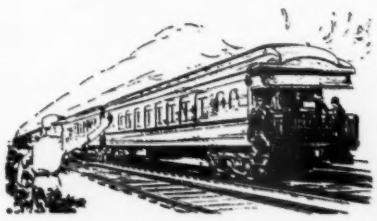
American Railway Engineering Association

During the last week in November, Bulletin No. 413, the first to contain committee reports to be presented at the convention next March, was mailed to members, this bulletin including the reports of the committees on Standardization, Electricity, Signals and Interlocking, Uniform General Contract Forms, Economics of Railway Location and Operation, and Waterways and Harbors. Bulletin No. 414, which will be mailed during December, will include reports of the committees on Clearances, Highways, Water Service, Buildings, Yards and Terminals, Records and Accounts, Economics of Railway Labor, Maintenance of Way Work Equipment and Rules and Organization.

It is announced that the Association of American Railroads has appropriated a total of $60,000 for research work to be sponsored by A.R.E.A. committees during 1940, this including the continuation of several projects already under way, and three new projects. The appropriations for new projects include $4,000 for the use of the Committee on Impact for work of analyzing data compiled in previous tests; an appropriation of $1,000 for the use of the Committee on Track for investigating the welding of manganese castings used in special trackwork; and an appropriation of $600 to the Committee on Track for the purchase of extensometers to be used in its investigation of tension in track bolts.

Five committees held meetings during November, two of these meetings extending over from October. These were as follows: Ties, at Macon, Ga., and Montgomery, Ala., on October 31 and November 1; Records and Accounts, at Chicago, on October 31 and November 1; Economics of Railway Labor, at St. Louis, Mo., on November 2; Masonry, at Chicago, on November 9 and 10; and Track, at Chicago, on November 16.

Only two committees have scheduled meetings for December, these being Rail, at New York, on December 7, and Waterproofing of Railway Structures, at Chicago, on December 8 and 9.



Personal Mention

General

Howard W. McCauley, trainmaster-roadmaster of the Minnesota & International (controlled by the Northern Pacific), with headquarters at Bemidji, Minn., has been appointed trainmaster on the Northern Pacific, with headquarters at Jamestown, N.D.

P. J. Weiland, roadmaster on the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Ottumwa, Iowa, has been promoted to trainmaster, with headquarters at Austin, Minn. Mr. Weiland was born at Bridgewater, S.D., on July 5, 1902, and entered railway service on April 1, 1916, as a section laborer at Bridgewater. On July 1, 1920, he was promoted to section foreman at that point and was later transferred to Mitchell, S.D. He was promoted to extra gang foreman on September 1, 1923, and on July 1, 1926, he was advanced to assistant roadmaster on the I. & D. division. In June, 1927, he was further promoted to roadmaster, with headquarters at Ottumwa.

John H. Hande, accounting engineer of the Baltimore & Ohio, has been appointed auditor capital expenditures, with headquarters at Baltimore, Md. Mr. Hande

John H. Hande

was born at Park Ridge, Ill., on May 21, 1885, and studied engineering at the University of Wisconsin. From 1905 to 1911 he was an assistant engineer on the Chicago & North Western and inspector on the rehabilitation of the Chicago street railways. From November, 1911, to July, 1914, he served as division engineer with the Duluth, Winnipeg & Pacific on construction from the iron range into Duluth, Minn., and in the valuation of this railroad's properties for the State Railroad and Warehouse Commission. Two years prior to going with the Baltimore & Ohio he was a sales engineer in Duluth and Chicago. Mr. Hande entered the service of the Baltimore & Ohio in January, 1917, as an assistant engineer on federal valuation of the road's Chicago Terminal properties. He later became successively special engineer on the staff of the chief engineer and improvement engineer. Mr.

Hande became accounting engineer in July, 1922.

Carl H. Burgess, trainmaster on the Northern Pacific at Tacoma, Wash., and an engineer by training and experience, has been promoted to assistant superintendent of the Tacoma division, with headquarters at Tacoma. Mr. Burgess was born at Worcester, Mass., on February 17, 1894, and graduated in civil engineering from Worcester Polytechnic Institute in 1916. He entered railway service on June 19, 1916, as a trackman on the Northern Pacific at Billings, Mont., and on October 1, 1916, he was promoted to rodman, later being advanced to draftsman and assistant engineer. On April 23, 1923, he was promoted to assistant roadmaster at Livingston, Mont., and on January 26, 1925, he was advanced to roadmaster, serving in that capacity at Fargo, N.D., and Glendive, Mont., until April 22, 1929, when he was promoted to division roadmaster of the Dakota division, with headquarters at Jamestown, N.D. On February 1, 1936, he was promoted to trainmaster-roadmaster, with headquarters at Missoula, Mont., and on July 16, 1936, Mr. Burgess was appointed trainmaster at Pasco, Wash., and he was later transferred successively to Auburn, Wash., and Tacoma.

Karl A. Borntrager, assistant engineer in the office of the executive vice-president of the New York Central at New York, has been promoted to superintendent of the Ohio Central division of the New York Central, with headquarters at Columbus, Ohio. Mr. Borntrager was born at Townville, Pa., on January 2, 1892, and graduated in civil engineering from Ohio State University in 1916. He entered railway service in April, 1917, as an assistant engineer in the valuation engineer's office of the Toledo & Ohio Central (now the Ohio Central division of the N.Y.C.), at Columbus, and in June, 1923, Mr. Borntrager was promoted to assistant division engineer, with headquarters at Charlestown, W. Va. On January 1, 1925, he was advanced to assistant engineer in the chief engineer's office at Columbus. In April, 1925, he was appointed resident engineer on construction, at Toledo, Ohio, and in May, 1926, he was promoted to assistant engineer in the office of the executive vice-president, with headquarters at New York City.

Karl A. Borntrager

Robert E. Woodruff, operating vice-president of the Erie, and an engineer by training and experience, has been appointed co-trustee and chief executive officer, with jurisdiction over all departments, and with headquarters as before at Cleveland, Ohio. Mr. Woodruff was born on a farm near Green Bay, Wis., on September 11, 1884, and graduated in civil engineering from Purdue University. He entered railway service in June, 1905, as a section laborer on the Erie, and thereafter served successively as a section foreman, transitman, construction engineer, assistant division engineer, division engineer at Meadville, Pa., and trainmaster until March, 1909, when he was promoted to general agent, operating department, of the Chicago Terminal. He was advanced to division superintendent, with headquarters at Rochester, N.Y., in December, 1910, and later was promoted successively to superintendent of transportation, general superintendent of the lines West, and manager of the Hornell region.

Robert E. Woodruff

On February 15, 1927, he was appointed general manager of the Eastern district, with headquarters at Hornell, N.Y., and on December 1, 1928, he was promoted to assistant vice-president, with headquarters at New York. Mr. Woodruff was elected vice-president in charge of maintenance and operation, with headquarters at New York, on May 24, 1929, and his headquarters were later transferred to Cleveland, Ohio.

Engineering

W. E. Bickel has been appointed engineer of water service of the Denver & Rio Grande Western, with headquarters at Denver, Colo., succeeding **C. E. Trammell.**

M. T. Terrill, assistant engineer on the Union Pacific, has been promoted to assistant to the chief engineer, with headquarters at Omaha, Neb., succeeding **T. R. Rutledge,** whose death, on October 4, was announced in the November issue.

H. P. Lessler has been appointed office engineer on the Denver & Rio Grande Western at Pueblo, Colo., succeeding **George Conrey,** who has been appointed engineering assistant in the budget bureau at Denver, Colo.

John M. Nicholson, assistant engineer on the Pennsylvania, has been appointed assistant to the chief engineer of the New York Zone of that road and the Long Island. Mr. Nicholson joined the staff of the Long Island as a draftsman, following his graduation from Columbia University in 1903 with the degree of civil engineer. During the World War Mr. Nicholson assisted in planning the Bay Ridge army base and the South Brooklyn navy supply depot. He has worked on virtually all grade separation improvements of the Long Island since 1903 and of the Pennsylvania (New York Zone) since 1928. At the present time he is engaged on grade separations in Nassau and Suffolk counties as well as on the Atlantic avenue, Aqueduct and Rockaway Beach elimination projects in New York.

John M. Nicholson

Earl L. Mayne has been appointed office engineer in the office of the chief engineer of the Western lines of the Atchison, Topeka & Santa Fe at Amarillo, Tex., succeeding **William Pirschell,** whose death on October 23 is announced elsewhere in these columns.

E. T. Barrett, engineer of track of the Denver & Rio Grande Western, with headquarters at Denver, Colo., has been appointed division engineer, with headquarters at Grand Junction, Colo., succeeding **G. M. Darby,** who has been transferred to Pueblo, Colo., relieving **F. R. Puder,** who retired on December 1.

Alphonse A. Winter, whose appointment as chief engineer in charge of roadway matters of the Atlanta & Saint Andrews Bay, with headquarters at Dotham, Ala., was announced in the November issue, was born on April 16, 1892, at Brunswick, Ga. He received his higher education at the University of Georgia, graduating in 1914 with a bachelor of science degree in civil engineering. Mr. Winter first entered railway service on July 1, 1914, as a draftsman with the Central of Georgia at Savannah, Ga., where he remained until January, 1916, when he was appointed assistant engineer, with the same headquarters. He held this position until March, 1918, when he was promoted to division assistant engineer at Savannah. From July, 1918, to January, 1919, he was with the United States Army, then return-

ing to the Central of Georgia as division assistant engineer at Savannah. From February, 1932, to November, 1936, Mr. Winter was engaged in other work, returning to railroad service at the end of this period as a civil engineer with the Atlantic & Saint Andrews Bay at Dotham. In February, 1937, he was placed in charge of the engineering department with the title of engineer, holding this position until his recent appointment as chief engineer.

I. L. Pyle, who has been appointed chief engineer of the Chesapeake & Ohio at Richmond, Va., as reported in the October issue, was born in Philadelphia, Pa., and educated in that city. He entered the service of the Chesapeake & Ohio on July 1, 1902, at Huntington, W. Va., and served successively until April 1, 1918, as levelman, transitman, draftsman and resident engineer on various construction projects between Hinton, W. Va., and Cincinnati, Ohio. Mr. Pyle went to Richmond on April 1, 1918, as assistant engineer and three years later was appointed assistant engineer of construction. He became assistant to the chief engineer on January

I. L. Pyle

1, 1923, and on March 1, 1923, was promoted to assistant chief engineer, in which position he served until his recent appointment as chief engineer.

Charles R. Strattman, whose promotion to division engineer on the Michigan Central, with headquarters at Jackson, Mich., was announced in the November issue, was born at Waldheim, La., on November 9, 1887, and graduated in civil engineering from Louisiana State University in 1919. He entered railway service in April, 1905, as a laborer on bridge construction on the New Orleans Great Northern (now part of the Gulf, Mobile & Northern) and later served as a chainman and rodman on construction work. From September, 1906 until June, 1908, he attended Louisiana State University, working during the summer of 1907 as a rodman on the N.O.G.N. and returning to that road as a rodman again in June, 1908. Mr. Strattman went with the Michigan Central in May, 1909, and served that road as a rodman and later as an instrumentman until August, 1911, when he went to the Canadian Pacific as a levelman and transitman on location and later as an instrumentman on construction. In April, 1913, he was promoted to resident engineer and in June, 1914, he left railroad service and in September, 1915, he returned to Louisiana

Charles R. Strattman

University. After graduation, he worked for a short period for an oil company and later for the American Bridge Company, Pittsburgh, Pa., returning to railroad service in October, 1920, as an instrumentman on the Michigan Central. Mr. Strattman was advanced to assistant engineer in November, 1920, and in April, 1934, he was promoted to supervisor of track, with headquarters at Jackson, Mich., later being transferred to Lansing, Mich., where he was located at the time of his recent promotion.

H. A. Dixon, chief engineer of the Western region of the Canadian National, with headquarters at Winnipeg, Man., has been appointed chief engineer of operation for the system, with headquarters at Montreal, Que., effective January 1, 1940, succeeding **C. B. Brown,** who will retire on pension. Mr. Dixon was born at Sand Hill, Ont., October 7, 1878, and was graduated from the School of Practical Science at Toronto and received his B. A. degree at the University of Toronto with honors in science. After working as a land surveyor in Ontario and Manitoba

H. A. Dixon

he joined the Canadian Northern at Winnipeg as a draftsman in 1903 and shortly afterwards became resident engineer. After serving in a supervisory capacity over engineering activities at Maryfield, Sask., Red Pass Junction, Resplendent, B.C., and Vancouver, B.C., he was advanced to chief engineer of the Western region, with headquarters at Winnipeg, the position he held until his recent promotion.

Mr. Brown was born on August 27, 1879, at Ithaca, N.Y., and was graduated from Cornell University in 1901 with a degree in civil engineering. He entered railway service in the same year as a draftsman for the Canadian Pacific, later serving as rodman, assistant engineer, resident engineer, assistant division engineer at Calgary, Alta., and division engineer at St. John, N.B., and Montreal. In 1912, Mr. Brown was promoted to principal assistant engineer of the Eastern lines and from 1913 to 1917 he was chief engineer of the Canadian Government Railways at Moncton, N.B. In 1917, he was promoted to assistant general manager of the Eastern lines and chief engineer of all lines. In 1918 he was appointed chief engineer of the Eastern lines of the Canadian National, and in 1920, engineering assistant to the vice-president, the position he held

C. B. Brown

until March, 1923, when he became chief engineer of operation.

Track

Leonard Sears, section foreman on the Atchison, Topeka & Santa Fe at Lawrie, Oklahoma, has been promoted to roadmaster, with headquarters at Guthrie, Oklahoma, relieving **Dan Healy,** who retired on November 3.

G. C. Modglin, section foreman and general foreman on the Chicago, Milwaukee, St. Paul & Pacific at Lake, Wis., has been promoted to roadmaster, with headquarters at Tacoma, Wash., succeeding **H. C. Davis,** who has been assigned to other duties.

D. J. O'Keefe has been appointed a roadmaster on the Southern Pacific, with headquarters at Niland, Cal., succeeding **J. L. Marsh,** who has been transferred to Colton, Cal., replacing **H. J. Pennington.** Mr. Pennington has been transferred to Ventura, Cal., relieving **T. Mills,** who has retired.

C. A. Parkin, section foreman and general foreman on the Chicago, Milwaukee,

St. Paul & Pacific at Greenleaf, Wis., has been promoted to roadmaster, with headquarters at Wausau, Wis., replacing **P. M. Loftus,** who has been transferred to Ottumwa, Iowa. Mr. Loftus succeeds **P. J. Weiland,** whose promotion to trainmaster is announced elsewhere in these columns.

A. A. Witter, section foreman on the Illinois Central at Newell, Iowa, has been promoted to track supervisor, with headquarters at Council Bluffs, Iowa, succeeding **E. R. Ward,** who has been transferred to Waterloo, Iowa. Mr. Ward replaces **J. R. Wartchow,** who remains at Waterloo, relieving **G. W. Parker,** who retired on November 30.

W. H. Lundy has been appointed a roadmaster on the Southern Pacific, with headquarters at Sparks, Nev., succeeding **J. J. Doyle,** who has been transferred to Klamath Falls, Ore., relieving **V. E. Parker.** Mr. Parker has been transferred to Albany, Ore., replacing **J. W. Davis,** who has been transferred to Marshfield, Ore., succeeding **R. D. Sorrels.** Mr. Sorrels has been transferred to Glendale, Ore., replacing **B. W. Redick,** who has been transferred to Portland, Ore., relieving **D. C. Harris,** who has retired.

N. M. Tullis has been appointed supervisor of track on the Western Maryland, with headquarters at Elkins, W. Va., and with jurisdiction west of Elkins, succeeding **C. V. Wolfe,** who has been transferred to Cumberland, Md., with jurisdiction from Cumberland to Elkins, including branch lines. Mr. Wolfe replaces **W. J. Pritt,** who has been transferred to the territory from Cumberland to Connellsville, Pa., including branch lines, with headquarters as before at Cumberland, relieving **F. A. Triplett,** who has retired.

Douglas A. Thomson, division roadmaster on the Northern Pacific, with headquarters at Glendive, Mont., has been promoted to trainmaster-roadmaster of the Minnesota & International (controlled by the Northern Pacific) with headquarters at Bemidji, Minn., succeeding **Howard W. McCauley,** whose appointment as trainmaster on the Northern Pacific at Jamestown, N.D., is announced elsewhere in these columns. **Hugh O. Whitten,** roadmaster at Billings, Mont., has been promoted to division roadmaster at Glendive, replacing Mr. Thomson, and **Hector Hanson,** roadmaster at Forsyth, Mont., has been transferred to Billings, relieving Mr. Whitten. **Nels M. Anderson,** roadmaster at Spokane, Wash., has been transferred to Forsyth, succeeding Mr. Hanson, and **George M. Cookson,** roadmaster at Fargo, N.D., has been transferred to Spokane, replacing Mr. Anderson. **Leslie H. Dahl** has been appointed roadmaster at Fargo, relieving Mr. Cookson.

P. B. Garrison, assistant supervisor of track on the New York Central, with headquarters at Lackawanna, N.Y., has been promoted to supervisor of track of Subdivision 31 of the St. Lawrence division, with headquarters at Remsen, N.Y., succeeding **Harry V. Smith,** who has been transferred to Subdivision 15 of the Buffalo division, with headquarters at North Tonawanda, N.Y., where he succeeds **G. W. Clark,** who has retired. **John V. Middleton,** a draftsman in the office of the engineer maintenance of way at New York, has been promoted to assistant supervisor of track at Lackawanna, to replace Mr. Garrison. **D. W. Johnston,** assistant supervisor of track of Subdivision 2 of the Electric division, with headquarters at Harmon, N.Y., has been promoted to supervisor of track of Subdivision 18 of the St. Lawrence division, with headquarters at Gouverneur, N.Y., succeeding **Stuart S. Humphrey,** who has been transferred to Subdivision 6 of the Mohawk division, with headquarters at Fonda, N.Y. Mr. Humphrey replaces **J. W. Bowe,** whose death is noted elsewhere in these columns. **A Westphal,** a track foreman, has been promoted to assistant supervisor of track on Subdivision 23 of the Syracuse division, with headquarters at Canandaigua, N.Y., to replace **William De Vries,** who has been transferred to Subdivision 10 on the same division, with headquarters at Lyons, N.Y. Mr. De Vries succeeds **J. E. Smith,** who has been transferred to Subdivision 2 of the electric division at Harmon, to relieve Mr. Johnston.

Mr. Garrison was born on March 10, 1892, at Fort Montgomery, N.Y., and entered railway service with the New York Central as a chainman at Weehawken, N.J., on September 3, 1915. Subsequently he was advanced successively through the positions of rodman and transitman, being on July 1, 1937, appointed a general foreman on the Buffalo division. On October 1 of the same year he was further promoted to assistant supervisor of track on the Buffalo division at Lackawanna.

Mr. Johnston was born on July 24, 1898, at Curry Run, Pa., and entered the service of the New York Central on March 1, 1919, as a laborer at that point. On September 25, 1919, Mr. Johnston was appointed a track foreman and on August 1, 1929, he was further promoted to assistant supervisor of track on the Pennsylvania division at Mahaffey, Pa. On August 1, 1935, he was transferred to the Eastern division, with headquarters at Brewster, N.Y., and on June 1, 1936, he was again transferred to the Electric division, with headquarters at Harmon.

Bridge and Building

R. J. Jackson, bridge and building foreman on the Canadian National at Saskatoon, Sask., has been promoted to acting bridge and building master, with headquarters at Saskatoon, succeeding **J. A. Crawford,** who has been granted a leave of absence because of illness.

Raymond Dejaiffe, assistant master carpenter of the Philadelphia Terminal division of the Pennsylvania who has been promoted to master carpenter of the Atlantic division and of the Pennsylvania-Reading Seashore Lines, with headquarters at Camden, N.J., as reported in the November issue, was born on January 28, 1908, at Ginter, Pa. Mr. Dejaiffe was educated at Pennsylvania State college, graduating in civil engineering in 1929. During summer vacations he worked on the Pennsylvania as a trackman and after his graduation he returned to this company as an assistant on the engineering corps. During the next six years he served in this capacity, as assistant supervisor of track and as a trackman. On December 16, 1935, he was appointed assistant supervisor of bridges and buildings on the Philadelphia division at Harrisburg, Pa., being appointed assistant master carpenter on the Philadelphia Terminal division at Philadelphia, Pa., on March 1, 1938. He was holding this position until his recent promotion to master carpenter, which was effective on October 1.

Obituary

J. W. Bowe, supervisor of track of Subdivision 6 of the Mohawk division of the New York Central, with headquarters at Fonda, N.Y., died on October 20.

J. L. Enright, supervisor of bridges and buildings on the St. Louis Southwestern, with headquarters at Tyler, Tex., died suddenly at his home in Texarkana, Ark., on October 31.

Ritchie G. Kenly, who retired on April 1, 1939, as chief engineer of the Minneapolis & St. Louis, with headquarters at Minneapolis, Minn., after 54 years railroad service, of which 30 were with the M. & St. L., died in Minneapolis on November 15. A sketch of Mr. Kenly's career, accompanied by a photograph, was published in the May issue of *Railway Engineering and Maintenance,* following his retirement last spring.

William Pirschell, office engineer in the office of the chief engineer of the Western lines of the Atchison, Topeka & Santa Fe at Amarillo, Tex., died on October 23, at the age of 55. Mr. Pirschell was born in Kansas City, Mo., and graduated in civil engineering from the University of Kansas in 1908. Shortly after graduation he entered the service of the Santa Fe and has been in continuous employment in various capacities in the engineering department since that time. He was promoted to office engineer in 1919.

T. R. Rutledge, assistant to the chief engineer of the Union Pacific, whose death on October 4 was announced in the November issue, was born at La Crosse, Wis., on July 10, 1883, and attended the University of Wisconsin for two years. He entered railway service in 1905 on the Chicago & North Western, in the superintendent's office at Madison, Wis., and on May 7, 1906, he went with the Union Pacific on double track work in Eastern Nebraska. In April, 1908, he returned to the North Western in Chicago, in connection with the construction of the new passenger station, but in August of that year returned to the engineering department of the Union Pacific, holding various positions in the chief engineer's office until June 16, 1922, when he was promoted to assistant to the chief engineer.

Hans Ibsen, who retired on February 1, 1932, as consulting bridge engineer of the Michigan Central, with headquarters at Detroit, Mich., died on October 22 at his home in Detroit after an illness of about three years. Mr. Ibsen was born in Bergen, Norway, on February 1, 1862, and received his technical education in that country. He came to the United States at the age of 20 years, and engaged in preliminary

HOW TO *Cut Drainage Costs* UNDER HIGH FILLS

Typical Armco Multi Plate Installations Under Railroad and Highway Fills			
Diameter In Inches	Gage Numbers	Fill Over Pipe In Feet	Location
75	7 & 5	54	California
90	7 & 5	49	California
97½	1	52	Iowa
105	1	84	Colorado
120	1	68	Colorado
120	1	50	Utah
135	3 & 1	42	California
135	1	43	Colorado
135	1	41	Colorado
150	3	45	California

This 105" Armco Multi Plate Pipe is installed under a 60-foot fill on a Federal Aid Highway in Colorado.

When drainage structures must withstand the crushing weight of high fills, you can depend on *added safety at less cost* by using Armco Multi Plate Pipe. Thousands of Multi Plate installations—many as large as 15 feet in diameter — are serving satisfactorily under highway and railway fills ranging up to more than 80 feet.

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work on a projected line of railroad in Pennsylvania. In 1889 he went to Norway for further technical study, returning to the United States in May, 1890, to enter the bridge department of the Michigan Central, later becoming chief draftsman and assistant bridge engineer. In August,

Hans Ibsen

1905, Mr. Ibsen was promoted to acting bridge engineer, with headquarters at Detroit, and later was appointed bridge engineer. In November, 1916, he was appointed special bridge engineer for the Michigan Central to design a new bridge over the Niagara Gorge at Suspension Bridge, N.Y., and retained this title until 1927, when he was appointed consulting bridge engineer, with headquarters as before at Detroit.

Richard C. Kendall, retired supervisor of bridges and buildings on the Chicago & Western Indiana, with headquarters at Chicago, whose death in that city on October 14 was announced in the November issue, was born at Exeter, England, on December 13, 1867, and entered railway service in December, 1888, with the Chicago, Burlington & Quincy. From April 1, 1892, until October 30, 1893, he worked for the Union Switch & Signal Company, helping install the exhibit at the Field Columbian Exposition in Chicago, returning to the service of the Burlington on November 1, 1893. On May 24, 1898, he was promoted to foreman of the building and repair gang at the Chicago terminal and on July 1, 1910, he went with the Chicago & Western Indiana as supervisor of bridges and buildings, with headquarters at Chicago, holding that position until his retirement on September 1, 1937.

Thomas Martin, division engineer of the Portage division of the Canadian Pacific, with headquarters at Winnipeg, Man., died on October 2, 1939, following a short illness. Mr. Martin was born in Ontario, Canada, on August 16, 1872, and graduated in civil engineering and also completed post graduate work in mining at the University of Toronto. He entered the service of the Canadian Pacific on May 4, 1902, as a division engineer at Cranbrook, B.C. During his 36 years service with the Canadian Pacific, Mr. Martin was located at various points on the Western lines, and during the years 1915 and 1916 was one of the engineers in charge of the construction of the five-mile Connaught tunnel through the Selkirk mountains in British Columbia. He also supervised the construction from 1930 to 1932, of the Canadian Pacific tunnel under the City of Vancouver, B.C., and following the completion of this work, was appointed division engineer at Winnipeg.

William W. K. Sparrow, officer in charge of finance, accounting and real estate of the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Chicago, an engineer by training and experience and formerly vice-president and a director of the Milwaukee, died suddenly on November 7, at Washington Boulevard Hospital in Chicago of a heart attack.

Mr. Sparrow was born in Ireland on December 30, 1879, and entered railway service in February, 1896, in the engineering department of the Belfast & North Counties Railway in Ireland. From February, 1899, to November, 1908, he served on railroad location, construction and maintenance in South Africa. He came to this country shortly thereafter and was employed by consulting engineers at Kansas City, Mo., and later became assistant chief engineer of the Missouri Public Service Commission. In September, 1916,

William W. K. Sparrow

he re-entered railroad service as valuation engineer of the Chicago, Burlington & Quincy, with headquarters at Chicago. During the period of Federal control of the railroads, from September, 1918, to March, 1920, Mr. Sparrow served as chief engineer of the Chicago, Milwaukee & St. Paul, and on the latter date he was appointed assistant chief engineer of that road. On June 1, 1920, he was appointed assistant to the president in charge of Federal valuation and settlement with the United States Railroad Administration. In April, 1923, he was elected vice-president in charge of the financial, accounting and real estate departments and in January, 1928, he was elected also a director of the Milwaukee. Since January 1, 1936, Mr. Sparrow's title has been officer in charge of finance, accounting and real estate.

Roger T. Taylor, division superintendent on the Northern Pacific, with headquarters at Tacoma, Wash., and an engineer by training and experience, died in a Tacoma hospital on October 14, following an extended period of ill health. Mr. Taylor was born at Lafayette, Ind., on August 21, 1884, and graduated in civil engineering from Purdue University in 1906. He entered railway service immediately following graduation as a rodman on construction work on the Northern Pacific and was later advanced to levelman, instrumentman and resident engineer on construction. In 1909, he was appointed assistant roadmaster and later was promoted to roadmaster at Dilworth, Minn. In 1914, he was advanced to trainmaster, with headquarters at Duluth, Minn., and in 1917, he was promoted to assistant to the general superintendent at Livingston, Mont. Mr. Taylor was appointed superintendent of icing facilities for the entire system, with headquarters at St. Paul, Minn., in 1925, and the following year, he was appointed assistant superintendent, with headquarters at Billings, Mont. He was promoted to superintendent of the Yellowstone division, with headquarters at Glendive, Mont., in July, 1927, and two years later, he was transferred to Fargo, N.D. Mr. Taylor was transferred to Spokane, Wash., in 1932, and to Tacoma in 1934, where he remained until his death.

W. O. Dennis, engineer maintenance of way of the Lehigh & New England, with headquarters at Bethlehem, Pa., died on November 16, of heart disease following a long illness. Mr. Dennis had been identified with the Lehigh & New England for more than 34 years. He was born at Nazareth, Pa., on December 31, 1882, and was educated at Nazareth Hall Military academy and Lafayette College, Easton, Pa. During summer vacations while attending college, Mr. Dennis served in various capacities in the engineering department of the L. & N. E. In the summer of 1905, after leaving school, he returned to the service of this company as a transitman, being advanced through various positions in the engineering department to that of assistant engineer, which position he held until March, 1913. At that time he was promoted to assistant supervisor of track, with headquarters at Pen Argyl, Pa., holding this position until

W. O. Dennis

April, 1917, when he was advanced to supervisor of track, with the same headquarters. In February, 1924, Mr. Dennis was further advanced to inspector maintenance of way, being in 1935 promoted to engineer maintenance of way.

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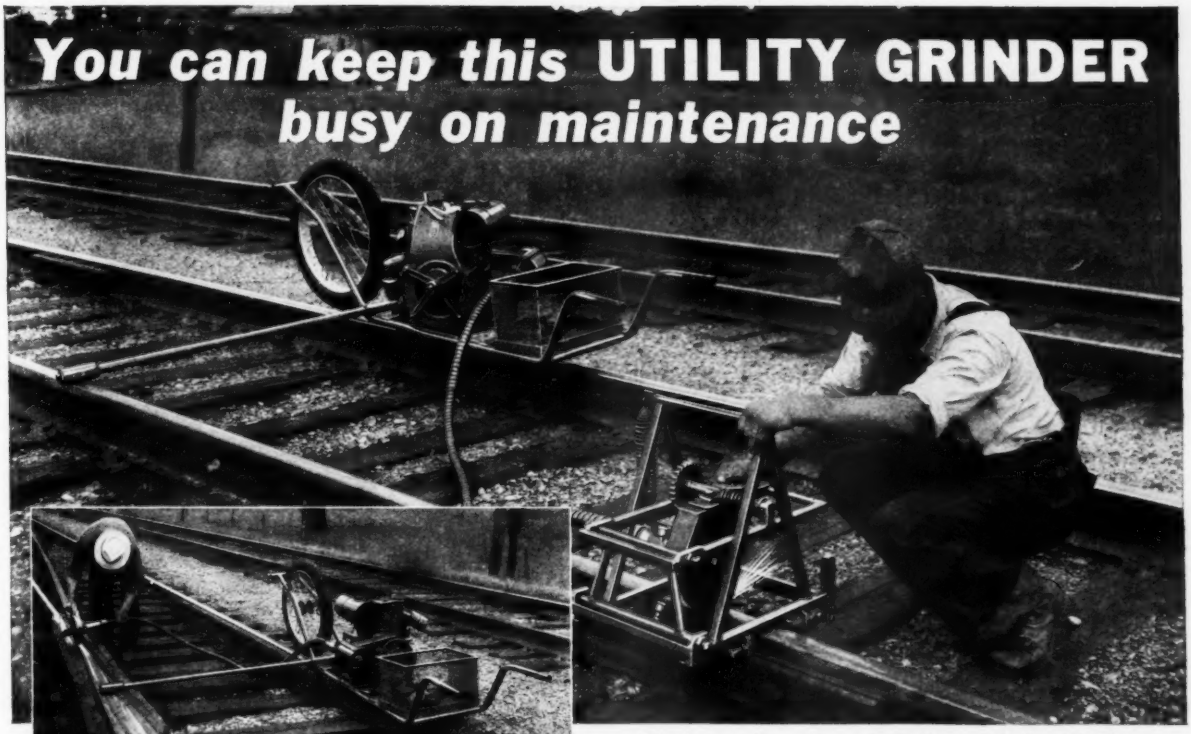
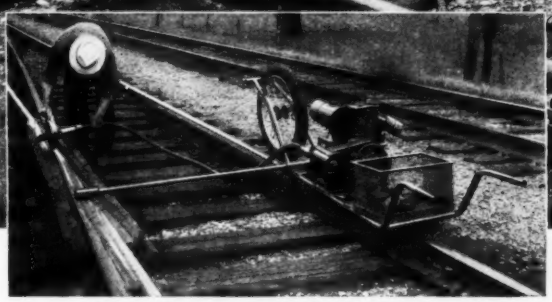


Slotting rail ends with Utility Grinder Slotting Guide.



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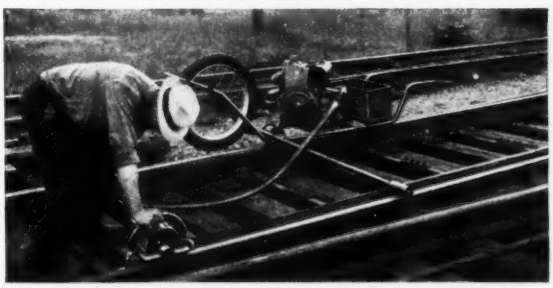
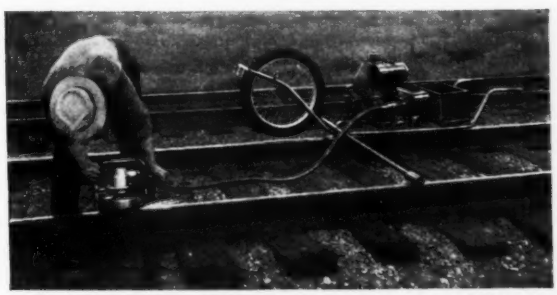


Removing flow at stock rail with Cup Wheel Accessory



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Supply Trade News

General

The Armco Culvert Manufacturers Association, Middletown, Ohio, has adopted a new name, the **Armco Drainage Products Association,** without change in officers. The new name has been adopted because of the increasing use and importance of products other than corrugated culverts manufactured by the members of this association.

Personal

George W. Hoover has opened an office at 30 Church street, New York, effective December 1, and will act as a railway sales representative in the eastern territory and for export. Mr. Hoover was formerly connected with the Buda Company as eastern and export sales manager.

Charles E. Wilson, executive vice-president, was elected president and **Phillip D. Reed,** assistant to the president, was elected chairman of the board of directors of the **General Electric Company** at a meeting of the board of directors in New York on November 17. They will take over their new responsibilities on January 1, succeeding **Gerard Swope** and **Owen D. Young,** who will become honorary president and honorary chairman of the board, respectively.

Col. Warren R. Roberts, chairman of the board of the **Roberts and Schaefer Company,** Chicago, has retired after 35 years' service with the company, **John J. Roberts,** secretary and treasurer, has been elected president, **John E. Kalinka,** vice-president, has been elected vice-president in charge of the railroad department, **Frank E. Meuller** has been elected vice-president and secretary, and **Frank M. Murphy** has been elected vice-president and treasurer.

Colonel Roberts was born in Sadorus, Champaign County, Ill., on October 20,

Col. Warren R. Roberts

1863, and graduated from the University of Illinois in 1888. He engaged in general engineering and contracting, and in 1904 became president of the Roberts and Schaefer Company, which position he held until 1926, when he was made chairman of the board.

John J. Roberts was born at Tolono, Ill. After attending the University of Illinois, he entered the construction business and in 1897 established a partnership with his brother, Col. Warren R. Roberts. In 1904, he helped organize the Roberts and Schaeffer Company and served as its secretary and treasurer until the present reorganization.

Mr. Kalinka was born in Tyrol, Austria, in 1888, and graduated from the Institute of Technology in Vienna. He entered

John J. Roberts

business as an engineer with the Southern Railways of Austria. He came to the United States in 1923 to engage in the

John E. Kalinka

construction of concrete arch bridges around Pittsburgh, Pa. Mr. Kalinka served for one year as an engineer on the Pennsylvania and in 1925 entered the railroad department of the Roberts and Schaeffer Company as a designing engineer, later being promoted to chief structural engineer. In 1934 he was made chief of the Z-D construction and railroad department and elected a director. In 1936 he was promoted to vice-president.

Obituary

Howard M. Starrett, chairman of the board and president of **Fairmont Railway Motors, Inc.,** died at a sanitarium in Boston, Mass., on November 23, after a short illness. Mr. Starrett was born in Toulon, Ill., in 1886, and entered the employ of the

Howard M. Starrett

Fairmont Company in 1909, after graduating from the mechanical engineering department of the University of Minnesota. In 1913, he resigned to accept employment with the Packard Motor Car Company and during the war served with the Bureau of Aircraft Production. In 1919, he again entered the employ of Fairmont, in charge of manufacturing, and in 1926, he was elected treasurer. Mr. Starrett was elected president and chairman of the board on May 23, 1939.

Trade Publications

The Welding of Wrought Iron—This is the title of a new 16-page booklet compiled by A. M. Byers Company, Pittsburgh, Pa. It supersedes and brings up-to-date the first edition produced early in 1934. Much progress has been made in the welding of wrought iron since this time, and the new data in the bulletin are based largely on recent tests, to which has been added considerable practical information obtained from the field.

Woolery Tie Cutter—A 12-page pamphlet describing the operation and economy of the Woolery Tie Cutter in tie renewal work has been published by the Woolery Machine Company, Minneapolis, Minn. The pamphlet compares other practices of inserting ties with the method used employing the tie cutter. Comparative cost figures are given and other advantages obtained with the use of the tie cutter are also emphasized. Numerous photographs and drawings are used to illustrate the pamphlet and it is printed attractively in color.

Mall Tools—The Mall Tool Company, Chicago, has issued loose-leaf catalog No. 339 in which are described flexible shaft equipment and portable power tools manufactured by this company. The products described include concrete vibrators of various types and sizes and the Mall power units for operating them, concrete surfacing machines, portable electric drills and saws, and terrazo grinders for base wall, stair, border and floor grinding. Also featured are an electric door plane, door lock mortiser and heavy duty disc sander. The catalog is well illustrated, detailed specifications of the units are given and their uses are described.

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General Superintendent The staff officer in direct charge of operation, finds many facts he needs to refer to instantly available in this book.

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Engineer Maintenance of Way He finds it particularly valuable as a reference work and also in conjunction with his contacts with division and district engineers. References to the Cyclopedia eliminate lengthy correspondence and assure definite understanding within his own staff and also in contacts with other departments.

Bridge Engineer He finds in the Cyclopedia a great deal of information regarding track, building and signal standards which he needs from time to time, in addition to a thoroughly up-to-date book on modern materials, equipment and methods of bridge work.

Building Engineer The Building Section gives the engineer in charge of building construction the recommended practices of the A.R.E.A., and valuable data of other branches of railway engineering with which he co-operates.

Signal Engineer Comprising the only complete and up-to-date book on signal equipment and maintenance practice in all its varied details, the Cyclopedia helps him to adapt his designs to those of the track and other departments.

Division Engineer This book is widely used by him as a one volume library. He finds it the most useful of his technical books.

Roadmaster and Track Supervisor To properly supervise the work of gang foremen and answer their many questions as to best methods of procedure, the roadmaster will find the Track Section a mine of information.

Bridge and Building Supervisor Who finds it a convenient means of verifying specifications and determining various methods of conducting bridge and building work as well as a handy reference to track and signal practice with which his work is so closely related.

Signal Supervisor The Dictionary Section is especially useful for the correct and concise definitions of the innumerable terms used in signaling, while the Signal Section and the five other large sections make it indispensable as a ready reference authority.

Water Service Supervisor The Water Service Section is an excellent treatise on the newest phases of the subject and is also used as a handy reference manual for standard requirements of other co-ordinated departments.

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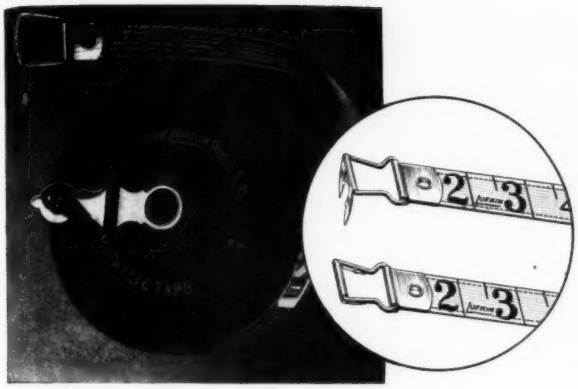

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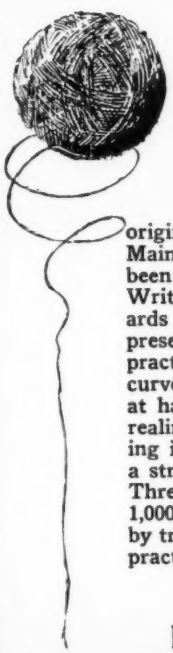

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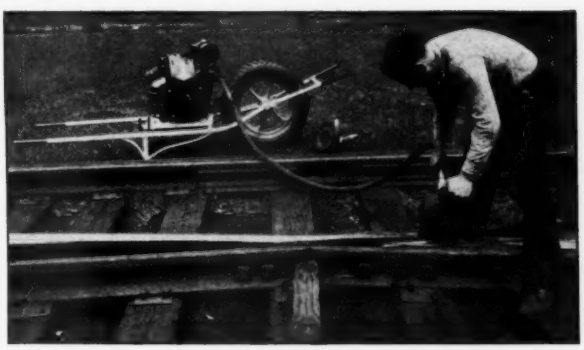

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"If that's the case, perhaps we can cut our advertising for a time."

"Cut our advertising! Boss, are you serious?"

"Why not. Let's save some money, if you're not going to get any orders anyway."

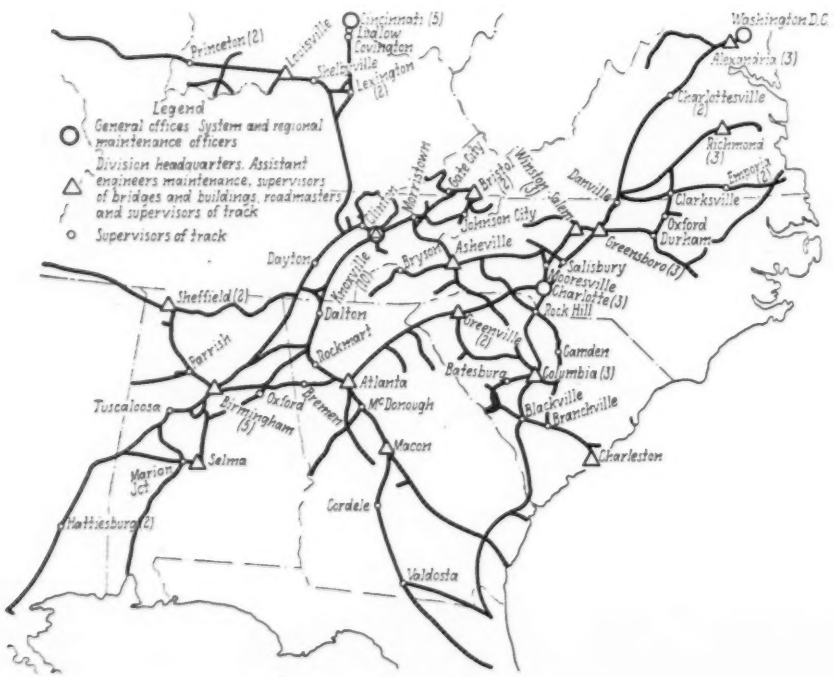
"But, Boss, you don't understand. This is the most important time in the year for us. It's the planting time for the harvest ahead."

"What do you mean?"

"I mean just this. I'm seeing everybody I possibly can to get our materials in the budgets they're now making up for their next year's programs. And I need all the advertising you can give me to get our story before the fellows I can't get around to see—and to keep it before the rest of them between calls. No sir, we can't *afford* to let up now when the business we've been looking for for years appears to be coming our way."

"I'm glad you feel that way about this advertising. We'll keep it up."

"Thanks, Boss, it'll help *me* a lot. And don't forget, that an item in the budget is more than half sold."



Railway Engineering and Maintenance Goes Every Month to 97 Supervisory Maintenance Officers of the Southern at **4 General Offices, 16 Division Offices, and 35 Other Supervisory Headquarters,** Scattered All the Way from Washington, D.C., and Alexandria, Va., to Charleston, S.C., Princeton, Ind., and Hattiesburg, Miss. This Magazine Goes Also to 59 Other Subordinate Officers Who Are in Training for Promotion to Supervisory Positions on This Railway.

RAILWAY ENGINEERING AND MAINTENANCE IS READ BY MAINTENANCE OFFICERS OF ALL RANKS

DO *EXPERT* RAIL GRINDING AT LOWER COSTS

WITH *Mall* TRADE MARK GRINDERS

MALL portable rail grinder powered with a gasoline engine.

Costly rail replacement can be avoided by building up the rail ends, frogs, and switch points by welding and by removing the excess metal with an efficient, high speed MALL rail grinder. These portable, lightweight grinders, available in many models, do the work quickly and at low cost.

Interchangeable attachments can be furnished for cross slotting, sawing, pumping, lag screw driving and drilling—actually many machines in one.

Write today for complete information!

MALL TOOL COMPANY
RAILROAD DEPARTMENT
7746 SOUTH CHICAGO AVENUE CHICAGO, ILLINOIS
SALES OFFICES IN ALL PRINCIPAL CITIES

3½ Times Tougher!

Every Simplex Track Jack is Electrided—the exclusive process that hardens the gibs or rack bar slide and which increases their surface hardness to approximately 450 Brinell as compared to an average hardness of good malleable iron of 120 Brinell.

They're approximately 3½ times tougher, last many times longer than Jacks with ordinary malleable rack bar housing, and our sales of repair parts to the many railways of the United States and the world have been radically reduced.

Have you the Simplex Railroad Jack bulletin? It covers Track Jacks, Rail Pullers and Expanders and G-Y Tie Spacers. Write for copy.

TEMPLETON, KENLY & CO.
Chicago, Ill.

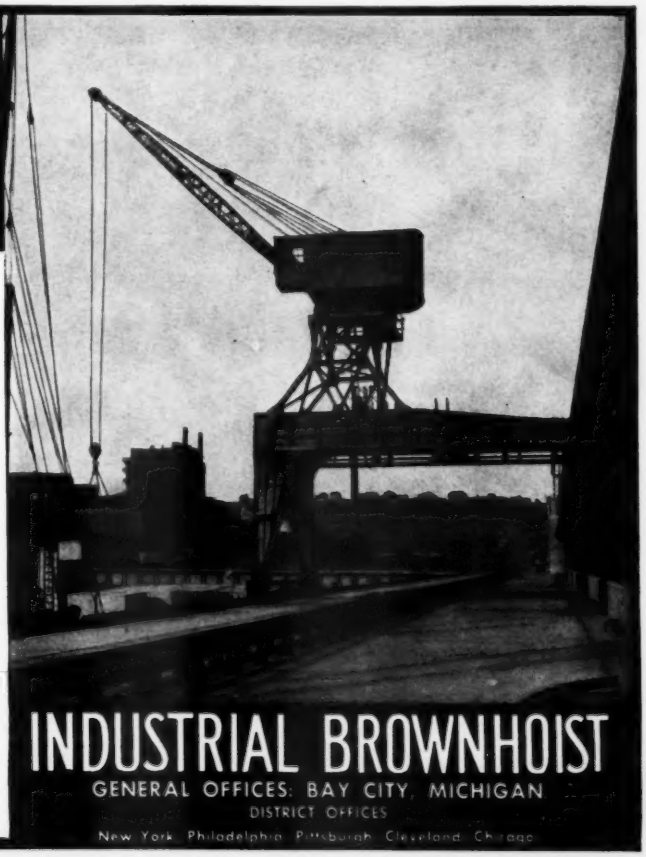
Cutting Maintenance of Way Costs Since 1899
Representatives in Principal Cities of the World

SIMPLEX
GOLD MEDAL AWARD SAFETY JACKS

Is your work DIFFERENT?

Standard locomotive and crawler cranes are readily adapted to most handling operations—to many even for which they might seem unsuited. However, when a special crane is required, the maker's experience is the best possible guarantee of dependable performance.

Is your crane work really different? Industrial Brownhoist can help you decide because we build the world's most complete line of locomotive cranes and heavy dock machinery, as well as crawler cranes, dock and shipbuilding cranes, vessel cranes and many other types. Should investigation show that a special crane is necessary, you will have the assurance that it will be just what you want because of our long and unique experience in crane building.



INDUSTRIAL BROWNHOIST
GENERAL OFFICES: BAY CITY, MICHIGAN
DISTRICT OFFICES
New York Philadelphia Pittsburgh Cleveland Chicago

JACKSON

UNIVERSAL TAMPERS

▼ *GET DOWN UNDER . . .*

and across the tie!

Making the first insertion under the rail—cross tamping (4-face). Note position of tampers and blade penetration.

In the first insertion of the tamping blade a void is made which, in successive insertions, is completely filled with the maximum of firmly-compacted ballast. Exactly the same operation can be done under each tie, and that makes your track stay up to grade uniformly for a long time.

But don't take our word for it — a demonstration is more convincing than reams of literature, so do what many railroad men are doing — find out why the Jackson Universal Tamper is superior for spotting, surfacing, skeletonizing and allied track maintenance operations — on your own track and under your own conditions. It will pay you.

DEMONSTRATIONS WITHOUT OBLIGATION

ELECTRIC TAMPER & EQUIPMENT CO., Ludington, Michigan

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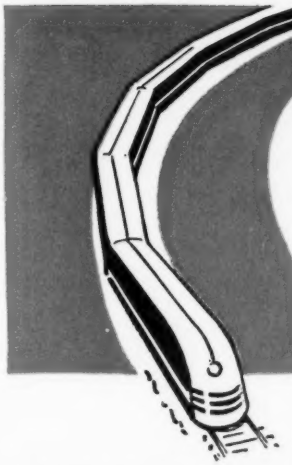
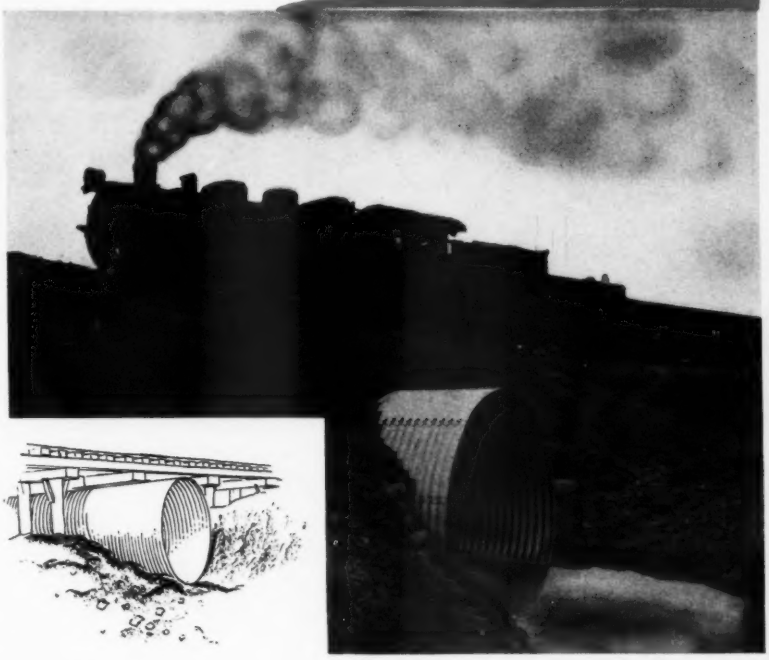


Modernize Right-of-ways to meet present day demands...with

TONCAN SECTIONAL PLATE PIPE



6 WAYS TONCAN SECTIONAL PLATE CAN SOLVE RIGHT-OF-WAY PROBLEMS QUICKLY AND ECONOMICALLY

1. Convert hazardous or failing wooden trestles into modern, permanent road-bed without interrupting train traffic.
2. Reline present condemned boxes and arches without interrupting train traffic.
3. Replace inadequate, failing bridges with maintenance-free, permanent structures.
4. Eliminate "wash-out" dangers in vulnerable spots, and repair washouts where they have occurred.
5. Provide quickest installed economical and permanent structure for new right-of-way construction.
6. Reduce greatly construction time on track relocation projects—at the same time providing greater permanence and dependability.

Not one train was stopped while the modern Toncan Sectional Plate structure in the photograph was replacing the old condemned wooden trestle shown in the sketch. Trestle is still in position under the fill.

● Construction time is cut to a minimum and repairs or replacements usually made without interrupting rail traffic, when Toncan Sectional Plate is used. Sectional Plate Pipe, diameters 60 to 180 inches, meets all today's right-of-way requirements for more strength, greater permanence, and lower maintenance costs. Hundreds of structures of this type are giving faultless service — many under fills in excess of fifty feet.

If you have a right-of-way construction problem let us show you how much better Toncan Drainage Structures fit today's requirements. Products include Corrugated pipe, Sectional Plate Pipe, Arches, Subdrainage Pipe and Flood Gates.

The Toncan Culvert Manufacturers' Association
Republic Building • • • Cleveland, Ohio

EMBLEM OF QUALITY AND SERVICE •

TONCAN CULVERT MANUFACTURERS' ASS'N. · · TONCAN

TONCAN DRAINAGE PRODUCTS

Made of Toncan Iron, an alloy of refined open-hearth iron, copper and molybdenum —that grows old slowly

TONCAN IRON—A PRODUCT OF REPUBLIC STEEL CORP.

FOR ADDED ECONOMY IN 1940

...budget these AIRCO items

Rising carloadings foretell increased maintenance operations during the coming year. To conduct these operations quickly and economically—more welding, cutting and flame hardening apparatus and supplies will be needed. So be sure you make provision in your new budget to meet these needs. » » » Time-proved Airco methods and equipment assure our railroad customers maximum benefits at low cost. Consult us on your welding and cutting problems.

AIR REDUCTION

SALES COMPANY

General Offices: **60 EAST 42nd ST., NEW YORK, N. Y. DISTRICT OFFICES IN PRINCIPAL CITIES**

● SERVING RAILROADS FROM COAST TO COAST ●